hp 5245L

Vic M. James

HEWLETT-PACKARD COMPANY / OPERATING AND SERVICE MANUAL

5245L
ELECTRONIC COUNTER

hp 5245L

CERTIFICATION

THE HEWLETT-PACKARD COMPANY CERTIFIES THAT THIS INSTRUMENT WAS THOROUGHLY TESTED AND INSPECTED AND FOUND TO MEET ITS PUBLISHED SPECIFICATIONS WHEN IT WAS SHIPPED FROM THE FACTORY.

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MANUAL CHANGES

MODEL 5245L

ELECTRONIC COUNTER

Manual Serial Prefixed: 408-
Manual Printed: 3/64

To adapt this manual to instruments with other serial prefixes check for errata below, and make changes shown in tables.

Instrument Serial Prefix	Make Manual Changes	Instrument Serial Prefix	Make Manual Changes
408-	ERRATA		

ERRATA:

Figure 5-35, Table 6-1,
Change: A25Q4 to 2N2043; hp Stock No. 1850-0092. Recommended replacement for all 5243A-65T assemblies.

Table 6-1,
Delete: MP39 Bracket; Transformer 5243A-12A

4/27/64

Supplement A for
05245-9001

OPERATING AND SERVICE MANUAL

MODEL 5245L
ELECTRONIC COUNTER

SERIALS PREFIXED: 408-

This manual applies directly to Model 5245L Electronic Counters having serial number prefix 408. This manual with changes provided in Appendix I also applies to Models having serial prefix numbers 402, 335, 328, 322, 316, 307, 305, 249, and 232 (see Paragraph 1-6).

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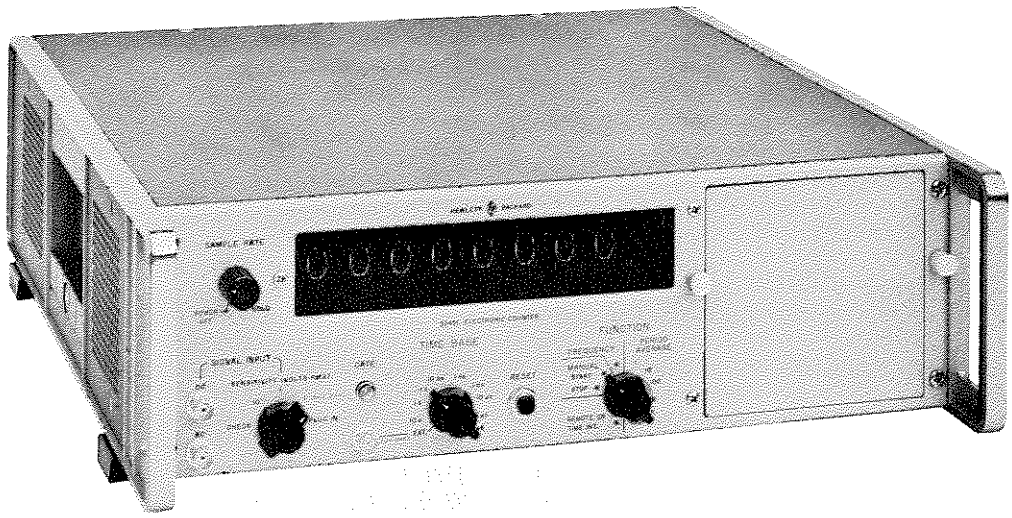
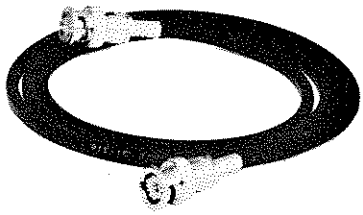
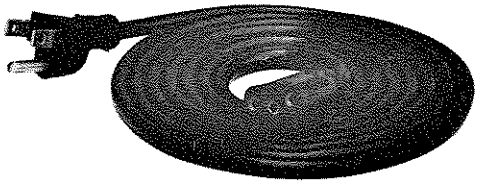
MODEL 5245L



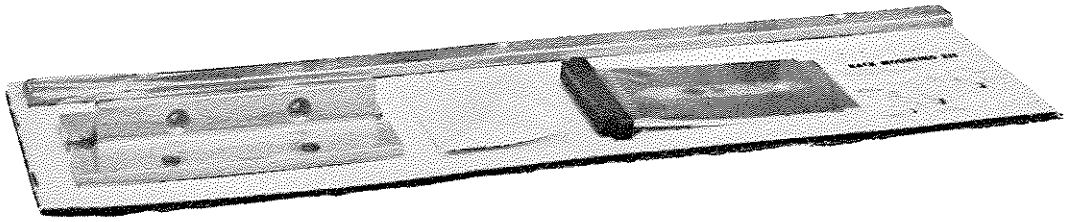
BNC TO BNC CABLE



POWER CABLE



RACK ADAPTER KIT



05245-A-12

Figure 1-1. Model 5245L and Accessories

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. DESCRIPTION.

1-3. The Model 5245L Electronic Counter is a high-frequency general-purpose electronic counter. The Model 5245L measures frequencies from 0 to 50 Mc, periods from 1 μsec to 10 seconds, period averages from 10 to 100,000 periods, the ratio of two frequencies, and the multiplied ratio of two frequencies.

1-4. The Model 5245L provides these additional features:

a. Decade scaling to 10^9 for any frequency to 50 Mc.

b. Standard output frequencies from 0.1 cps to 10 Mc in decade steps.

c. Four-line, binary-coded-decimal output to drive digital recorder (Model 562A), digital to analog converter (Model 580A/581A), remote readout, or data processing equipment (1-2-2-4 code; 1-2-4-8 code available at extra cost as Option 02).

d. Remote control by external contact closure.

e. Display storage which permits reading to be displayed while new count is made.

f. Eight-digit display using rectangular (narrow) digital display tubes; decimal point position and measurement units displayed automatically.

g. Operation with plug-in units which extend the basic range and performance of the counter.

1-5. The Model 5245L features solid state design, low power consumption, small size (5-1/4 inch panel height), light weight (32 lb), easy conversion for rack mounting, and modular plug-in circuit boards for simplified maintenance.

1-6. IDENTIFICATION.

1-7. Hewlett-Packard uses a two-section, eight-digit serial number (on instrument rear panel) to identify instruments (000-00000). The first three digits are a serial prefix number, and the last five digits refer to a specific instrument. If the serial prefix on your instrument does not appear on the title page of this manual, there are differences between the manual and your instrument which are described in the appendix (serial prefix 402 and below) or in a change sheet included with the manual. If the change sheet is missing, the information can be supplied by your nearest Hewlett-Packard field office.

1-8. AVAILABLE PLUG-IN UNITS.

1-9. MODEL 5251A.

1-10. The Model 5251A Frequency Converter extends the frequency range of the Model 5245L to 100 Mc. The Model 5251A mixes a selected 10-Mc harmonic (between 20 and 90 Mc) with the input signal. The resulting difference-frequency signal is amplified and provided to the basic counter for counting and display. Because the selected 10-Mc harmonic is derived from a harmonic generator driven by a 10-Mc output from the basic counter, the stability and accuracy of the basic counter are retained.

1-11. MODEL 5253B.

1-12. The Model 5253B Frequency Converter extends the frequency range of the Model 5245L to 512 Mc. The stability and basic accuracy are retained by multiplying a 10-Mc signal, derived from the counter's internal time base, to a known harmonic frequency. When this harmonic frequency is selected and mixed with the input signal frequency, the difference frequency produced is within the range of the basic counter and is displayed by the counter.

1-13. MODEL 5254A.

1-14. The Model 5254A Frequency Converter provides the Model 5245L with a frequency range from 500 to 2500 Mc. The stability and accuracy of the basic counter are retained by using a 50-Mc multiple of the crystal oscillator signal from the counter to beat with the signal being measured. The difference frequency produced is within the range of the basic counter and is displayed by the counter. The converter has an indicator which aids in frequency selection and indicates the output level to the counter. The required input signal level is 50 mv RMS to 1 v RMS. The input connector is a type N female.

1-15. MODEL 5261A.

1-16. The Model 5261A Video Amplifier Unit extends the sensitivity of the Model 5245L to 1.0 millivolt over the frequency range of 10 cps to 50 Mc. Input impedance is increased to 1 megohm and can be further increased to 10 megohms by use of an accessory 10:1 divider probe (10003A) for signals greater than 10 mv. A 50-ohm output is provided for oscilloscope monitoring of the amplified signal.

1-17. MODEL 5262A.

1-18. The Model 5262A Time Interval Unit provides start and stop pulses, initiated by electrical inputs, to the main count gate in the Model 5245L enabling it to make time interval measurements. Time intervals from 1 microsecond to 10^8 seconds are measured with a resolution of 0.1 microsecond. Basic counter accuracy is retained when the signal counted is derived from the internal oscillator.

Table 1-1. Specifications

FREQUENCY MEASUREMENTS

Range: 0 to 50 Mc

Gate Time: 1 μsec to 10 seconds in decade steps

Accuracy: ±1 count ± time base accuracy

Reads In: Kilocycles or megacycles with positioned decimal point; measurement unit displayed

Self Check: Counts 10 Mc for the gate time selected with the time base selector switch

SCALING

Frequency Range: 0 to 50 Mc

Factor: By decades up to 10^9; switch selected on rear panel

Input: Front panel, Signal Input

Output: Rear panel, in place of time base output frequencies.

PERIOD AVERAGE MEASURMENTS

Periods Averaged: 1 period to 10^5 periods in decade steps

Range: Single period: 0 to 1 Mc
Multiple period: 0 to 300 kc

Accuracy:
±1 count ±time base accuracy ± trigger error*

Frequency Counted:
Single Period: 10 Mc to 1 cps in decade steps
Multiple Period:
10 period - 1 cps to 10 Mc
100 period - 10 cps to 10 Mc
1,000 period - 100 cps to 10 Mc
10,000 period - 1 kc to 10 Mc
100,000 period - 10 kc to 10 Mc

Reads In:
Sec, ms, μs with positioned decimal point; measurement unit displayed

Self Check:
Gate time is 10 μs to 1 sec (periods averaged of 100 kc); counts 100 kc from the time base

RATIO MEASUREMENTS

Displays: (f_1/f_2) times period multiplier

Range: f_1: 0 to 50 Mc; f_2: 0 to 1 Mc in single period; 0 to 300 kc in multiple period; periods averaged 1 to 10^5 in decade steps

Sensitivity: 0.1 v RMS, each input

Accuracy:
±1 count of f_1 ± trigger error* of f_2; f_1 is frequency applied to the decimal counters (enters Time Base Ext. jack); f_2 is frequency applied to decade dividers (enters Signal Input jack)

Reads In:
Dimensionless; positioned decimal point for number of periods averaged

Self Check:
Period Average Self Check applies

TIME BASE

Frequency (Internal): 1 Mc

Stability:
Aging rate - less than ±3 parts in 10^9 per 24 hrs**

As a function of temperature - less than ±2 parts in 10^{10} per °C from -20°C to +55°C

As a function of line voltage - less than ±5 parts in 10^{10} for ±10% change in line voltage from 115 v or from 230 v RMS

Short term - less than ±5 parts in 10^{10} peak-to-peak with measurement averaging time of one second under constant environmental and line voltage conditions

Adjustment:
Fine frequency adjustment (range approximately 4 parts in 10^8) and medium frequency adjustment (range approximately 1 part in 10^6) are available from the front panel through the plug-in hole. Coarse frequency adjustment (range approximately 1 part in 10^5) is available at the rear of the instrument.

Output Frequencies (1) (rear panel):
0.1 cps to 10 Mc in decade steps; switch selected on rear panel; all frequencies available in manual function without interruption at reset; 10 kc to 10 Mc available continuously in all functions; 1kc available continuously for all functions except 100 K period average; stability same as internal time base; 5 v p-p rectangular wave with 1000 ohm source impedance at 1 Mc and lower; 1 v RMS sine wave with 1000 ohm source impedance only at 10 Mc

Output Frequencies (2) (front panel):
0.1 cps to 1 Mc in decade steps; selected by Time Base switch; availability as defined under Output Frequencies (1) above; stability same as internal time base; 1 v peak-to-peak

External Standard Frequency: 1 Mc, 1 v RMS into 1000 ohms required at rear panel BNC connector

*Trigger error is less than $\pm \frac{0.3\% \text{ of one period}}{\text{periods averaged}}$ for signals with 40 db or better signal to noise ratio at rated sensitivity.

** After 72 hours of continuous operation.

Table 1-1. Specifications (continued)

GENERAL

Registration:
8 digits in-line with rectangular Nixie® tubes and display storage; 99,999,999 maximum display; total width of 8 digit display including illuminated unit display and decimal point does not exceed 7 inches

Display Storage:
Holds reading between samples; switch overrides storage

Sample Rate:
Time following a gate closing during which the gate may not be reopened is continuously variable from less than 0.2 sec to 5 seconds in frequency mode, independent of gate time; display can be held indefinitely

Operating Temperature Range: -20°C to +65°C (See TIME BASE, Stability)

Connectors: BNC type except for remote programming and BCD output

Input: Maximum Sensitivity - 100 mv, RMS

Coupling - AC or DC, separate BNC connectors

Attenuation - Step attenuator provides ranges of 0.1, 1, and 10 volts

Impedance - 100 K ohms/volt (10 K ohms at 100 mv); approximately 40 pf on 0.1-volt range, 15 pf on 1- and 10-volt ranges

Overload - Diode clamps protect input circuit for up to 50 volts RMS signal on 0.1-volt range; 150 volts RMS on 1-volt range; 500 volts RMS on 10-volt range; AC coupling capacitance, 1 μf, 600 volts

Output:
4-line BCD 1-2-2-4, "1" state positive
"0" state level: -8 v
"1" state level: +18 v
Impedance: 100K, each line
Reference levels:
Approximately +17 v, 350-ohm source
Approximately -6.5 v, 1000-ohm source
4-line BCD 1-2-4-8 optional (levels as above)

Output is suitable for systems use or output devices such as ℎ Models 580A and 581A Digital to Analog Converters and includes the decimal point and measurements unit for ℎ562A Digital Recorder

Print Command: +13 v to 0 v step, DC-coupled

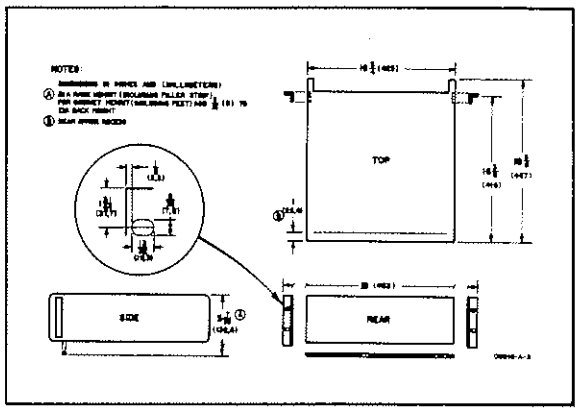
Cable Connector: Amphenol 50-pin 57-30500, one required

Hold-off Requirement:
+15 v min, +25 v max from chassis ground (1000-ohm source)

Remote Operation:
All functions which may be programmed from the front panel controls (in normal use) may be programmed from a remote location except for the "Sample Rate" (as defined above) and the sensitivity control setting. The instrument provides (through rear panel connectors) all voltages necessary for remote control. The programming voltages for Time Base and Function modes are low level: -15 v DC at 5 ma per gate. Control may also be achieved by using an external -15 v DC supply. The position of the decimal point and measurements unit may be correctly illuminated from the remote location, using +170 v DC from the internal or an external supply.

Cable Connector: Amphenol 36-pin 57-30360, two required

Dimensions:



Weight:
Net, 32 lbs (14.5 kg) with blank plug in;
Shipping, 48 lbs (21.5 kg)

Power Supply:
115 or 230 volts ±10%, 50 to 60 cps; 80 watts (50 to 1000 cps operation, price on request)

Accessories Furnished:
ℎ 10503A (AC-16K) Cable, 4 ft (122 cm) long, male BNC connectors
Detachable Power Cord, 7-1/2 ft (229 cm) long, NEMA plug
Circuit Board Extender

Option 02: 4-line BCD 1-2-4-8 "1" state positive, in lieu of 1-2-2-4; identical to standard ℎModel 5245L except for BCD code.

®Registered trademark of Burroughs Corporation.

1-19. MODEL 5264A.

1-20. The Model 5264A Preset Unit converts the 5245L to a preset time base counter while retaining its basic measurement functions and range. The 5264A permits the 5245L to:

Measure normalized frequency rate
measure normalized ratio
measure normalized period
count N events
divide an input frequency by N

In these measurements N may be any integer from 1 to 100,000 (N = 100,000 when all N switches are set to 0).

1-21. Such versatility is achieved by using a set of decade dividers in the 5264A to control the gate of the counter. These decade dividers, which may be preset to any integer from 1 to 100,000, open the counter's gate when the first pulse is received and close the gate when the Nth pulse is received. Separate output signals from the counter are available to operate other equipment whenever the gate opens or closes.

1-22. MODEL 5265A.

1-23. The Model 5265A Digital Voltmeter converts the 5245L to an accurate DC digital voltmeter. DC voltages as high as 1000 volts can be measured with six-digit presentation. Accuracy of the Digital Voltmeter is ±0.1% of the displayed reading or 0.01% of the full-range value for operating temperatures between +15°C and +40°C. Accuracy is maintained for over-range voltages of 5% on all ranges. The LOCAL-REMOTE switch permits remote selection of the digital voltmeter mode or operation from the plug-in controls. Polarity of the input DC voltage is automatically sensed and displayed.

1-24. APPLICATIONS.

1-25. GENERAL.

1-26. The Model 5245L can measure frequencies from 0 to 50 Mc directly, to 2500 Mc when used with available plug-in units, and to 18,000 Mc when used with the Model 540B Transfer Oscillator and Model P932A Harmonic Mixer. It can measure speed, rpm, acceleration, vibration, and other phenomena when they are converted to sine waves or pulses. It can simplify the design, test, and calibration of filters, oscillators, scalers, and other devices which require critical frequency or time interval measurements in their manufacture or maintenance. Remote control and BCD output make the Model 5245L ideal for systems use.

1-27. HIGH RESOLUTION ANALOG PLOT.

1-28. The Model 5245L (with Model 5253B and 5254A Frequency Converters) when used with the Model 581A Digital to Analog Converter and the Moseley Model 680 Strip Chart Recorder provides an analog plot of frequency stability for frequencies as high as 2500 Mc. This combination provides full scale chart resolution of 100 cps (4 parts in 10^8 at 2500 Mc) with 1 second gate time and 10 cps (4 parts in 10^9 at 2500 Mc) with 10 second gate time.

1-29. In Figure 1-2 the frequency being measured is 489.5 Mc. The Model 5245L with plug-in unit measures and displays the input frequency with 1 cps resolution (counter set for 1 second gate time). The Model 581A converts the BCD output from the last two decimal counting assemblies in the Counter (outputs for any three consecutive digits or the two least significant digits may be selected for conversion in the Model 581A) to drive the Recorder. A change of 10 cps in the input frequency will drive the recorder pen one major division on the chart.

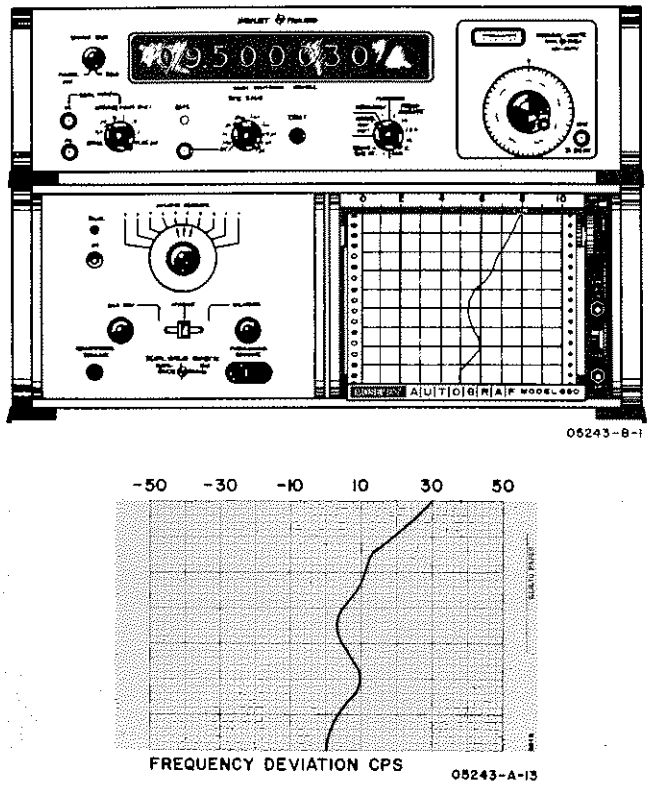


Figure 1-2. Frequency Stability Plot

1-30. Any phenomena which can be measured by the Model 5245L can be plotted in this way with resolution determined by counter gate time and Model 581A column selection.

1-31. TERMINOLOGY.

1-32. The definitions of the following terms apply to those terms as they will be used throughout the manual.

a. BINARY. A bistable multivibrator (flip-flop) used to count or store binary information. The output of each binary is a "bit" or binary digit.

b. DECIMAL WEIGHT. Numerical value assigned to the output of each binary. In a 1224 code, decimal weights are assigned as follows: A binary; 1; B binary, 2; C binary, 2; D binary, 4.

c. "1" STATE. One transistor in binary conducting, output of binary indicates decimal weight present.

d. "0" STATE. Opposite transistor in binary conducting, output of binary indicates decimal weight absent.

e. 4-LINE BCD. Four-line binary-coded-decimal; decimal information coded in such a way that each decimal digit may be represented by a unique combination of 1 and 0 states of four binaries.

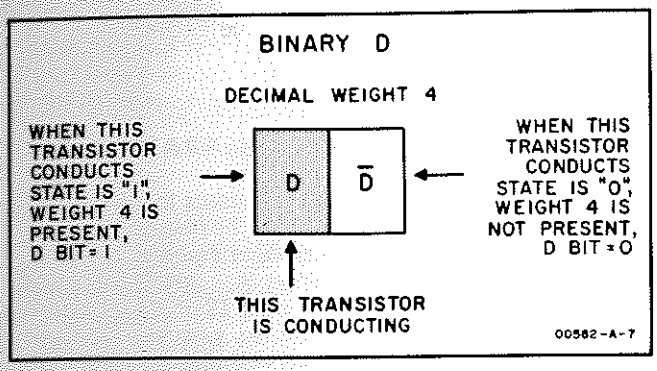

BINARY D
DECIMAL WEIGHT 4
WHEN THIS TRANSISTOR CONDUCTS STATE IS "1", WEIGHT 4 IS PRESENT, D BIT = 1
D
D̄
WHEN THIS TRANSISTOR CONDUCTS STATE IS "0", WEIGHT 4 IS NOT PRESENT, D BIT = 0
THIS TRANSISTOR IS CONDUCTING
00562-A-7

Figure 1-3. Binary Symbol

f. TRUTH TABLE. A table which lists the allowable 1 or 0 states of a system of binaries for each decimal digit to be represented. These states are listed in an order which presents the most significant digit first. Example: In a 1224 code, binaries D, C, B, and A are assigned decimal weights of 4, 2, 2, and 1 respectively. The decimal numeral 5 is represented by state 0111 and weights of 2, 2, and 1 are present. The allowable combination (0111) is listed in the truth table (Table 1-2).

1-33. OPTIONAL BCD OUTPUT (OPTION 02).

1-34. The Model 5245L is available with 1-2-4-8 "1" state positive BCD output. In the Model 5245L, Option 02, decimal counter assemblies with 1-2-4-8 outputs have been substituted for the standard assemblies. These substitutions have been made: A10 through A14, 300 kc counter assemblies; ℗ stock no. 5212L-4A replaced by ℗ stock no. 05212-6002. A15, A16, 5 Mc counter assemblies; ℗ stock no. 5232L-4B replaced by ℗ stock no. 05232-6002. A18, 50 Mc readout assembly; ℗ stock no. 5245L-4B replaced by ℗ stock no. 05245-6001. The Model 5245L, Option 02, is identical in all respects to the standard Model 5245L except for BCD code. Table 1-3 is a truth table for the 1-2-4-8 BCD code, and Figures 2A-1 through 2A-3 in the appendix provide schematic diagrams for the 1-2-4-8 decimal counter assemblies.

Table 1-2. Four-Line Code Truth Table

Digit	4-Line Code, 1-2-2-4 0 -, 1 +			
	D = 4	C = 2	B = 2	A = 1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	1	0
5	0	1	1	1
6	1	1	0	0
7	1	1	0	1
8	1	1	1	0
9	1	1	1	1

Table 1-3. 1-2-4-8 Code Truth Table

Digit	4-Line Code, 1-2-4-8 0 -, 1 +			
	D = 8	C = 4	B = 2	A = 1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

SECTION II
INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information on unpacking, inspection, repacking, storage, and installation.

2-3. UNPACKING AND INSPECTION.

2-4. Inspect instrument for shipping damage as soon as it is unpacked. Check for broken knobs and connectors; inspect cabinet and panel surfaces for dents and scratches. A performance check is given in Paragraphs 5-22 thru 5-36. If instrument is damaged in any way or fails to operate properly, notify carrier immediately (see warranty sheet at rear of manual). For assistance of any kind, including help with instruments under warranty, contact your Hewlett-Packard field office.

2-5. STORAGE AND SHIPMENT.

2-6. PACKAGING. To protect valuable electronic equipment during storage or shipment always use the best packaging methods available. Your Hewlett-Packard field office can provide packing material such as that used for original factory packaging. Contract packaging companies in many cities can provide dependable custom packaging on short notice. Here are a few recommended packaging methods:

a. RUBBERIZED HAIR. Cover painted surfaces of instrument with protective wrapping paper. Pack instrument securely in strong corrugated container (350 lb/sq in. bursting test) with 2-inch rubberized hair pads placed along all surfaces of the instrument. Insert fillers between pads and container to ensure a snug fit.

b. EXCELSIOR. Cover painted surfaces of instrument with protective wrapping paper. Pack instrument in strong corrugated container (350 lb/sq in. bursting test) with a layer of excelsior about 6 inches thick packed firmly against all surfaces of the instrument.

2-7. ENVIRONMENT. Conditions during storage and shipment should normally be limited as follows:

a. Maximum altitude, 20,000 feet.

b. Minimum temperature -40°F (-40°C).

c. Maximum temperature 167°F (75°C).

2-8. RACK INSTALLATION.

2-9. The Model 5245L is ready for bench operation as shipped from the factory. Additional parts necessary for rack mounting are packaged with the instrument. To convert for rack installation, refer to Figure 2-1 and proceed as follows:

a. Remove tilt stand.

b. Remove feet (press the foot-release button, slide foot toward center of instrument, and lift off).

c. Remove adhesive-backed trim strips at front end of sides.

d. Attach flanges to front end of sides (larger corner-notch toward bottom of instrument).

e. Attach filler strip along bottom edge of front panel. Instrument is now ready to mount in standard rack.

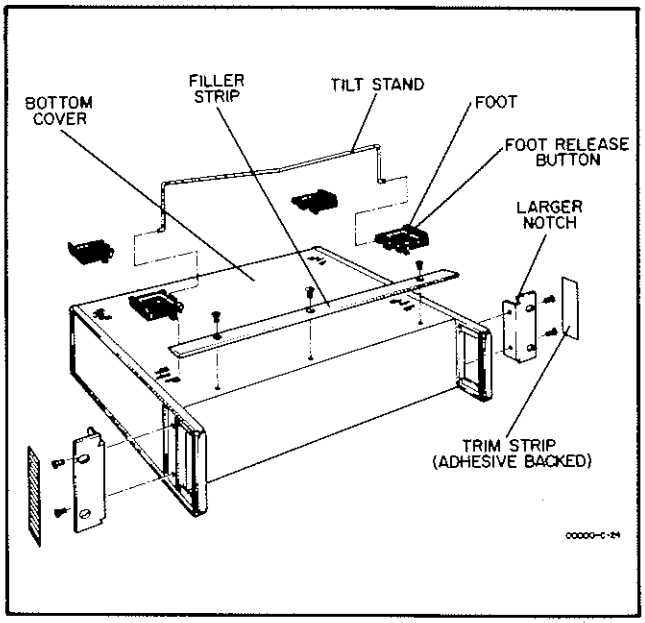


Figure 2-1. Conversion for Rack Mounting

CAUTION

Ambient temperature in rack during operation should not exceed a maximum of 131°F (55°C). Be sure instrument position in rack permits air circulation to intake in center area of rear panel and that nearby instruments do not discharge hot air near intake.

2-10. POWER CONNECTION.

2-11. LINE VOLTAGE. The Model 5245L may be operated from either 115- or 230-volt (±10%) power lines. A slide switch on the rear panel permits quick conversion for operation from either voltage. Insert a narrow-blade screwdriver in the switch slot and slide the switch to the right for 230-volt operation ("230" marking exposed) or to the left for 115-volt operation ("115" marking exposed). The Model 5245L is supplied with 115-volt fuse; be sure to replace this fuse for 230-volt operation; see Table 2-1.

CAUTION

Before plugging instrument into AC power line be sure slide switch is properly positioned.

Table 2-1. 115/230 Volt Conversion

Conversion	115 Volt	230 Volt
Slide switch	Left ("115")	Right ("230")
AC LINE FUSE	2 ampere slow-blow (2110-0006)	1 ampere slow-blow (2110-0007)

2-12. POWER CABLE. The Model 5245L is equipped with a detachable 3-wire power cable. Proceed as follows for installation.

a. Connect flat plug (3-socket connector) to AC line jack at rear of instrument.

b. Connect plug (2-blade with round grounding pin) to 3-wire (grounded) power outlet. Exposed portions of instrument are grounded through the round pin on the plug for safety; when only 2-blade outlet is available, use connector adapter (stock no. 1251-0048), then connect short wire from side of adapter to ground.

Note

To maintain oscillator stability, crystal oven circuits are energized continuously when the Model 5245L is connected to power line.

2-13. COOLING.

2-14. The Model 5245L uses forced air cooling. The air intake and filter are located on the rear panel of the instrument. Inspect the filter regularly; clean the filter before it becomes dirty enough to restrict air flow (see Paragraph 5-3 for instructions on filter care).

Note

Do not apply coating compounds to the filter.

SECTION III
OPERATION

3-1. INTRODUCTION.

3-2. The Model 5245L measures frequency, period average, ratio of two frequencies, and total events. A FUNCTION selector switch selects measurement function, and a TIME BASE selector switch selects time base or multiplier. A SAMPLE RATE control selects the sampling rate, and a SENSITIVITY control adjusts instrument sensitivity. Figures 3-4 through 3-9 provide step-by-step operating procedures for each measurement function. Figures 3-10 through 3-14 provide operating procedures for measurements made with available plug-in units. The number or numbers associated with each control indicate the step in which that control is used.

3-3. INTERPRETING DISPLAY.

3-4. Direct readout is provided in both PERIOD and FREQUENCY functions with measurement units displayed and with decimal point automatically positioned. In the MANUAL function the display is read directly; the decimal point is not lighted. Note that the only difference between ratio and period measurements is the use of an external frequency instead of the internal 1-Mc oscillator.

3-5. ACCURACY.

3-6. FREQUENCY MEASUREMENTS. The basic counter accuracy is determined by two factors. One factor is the aging rate of the 1-Mc crystal standard in the time base, which is less than 2 parts in 10^8 per week. A second factor is the inherent error of ±1 count present in all counters of this type. This error is due to phasing between the timing pulse that operates the electronic gate and the pulses that pass through the gate to the counters. The chart in Figure 3-1 shows the errors possible for frequency or period measurements.

3-7. PERIOD MEASUREMENTS. There are three factors contributing to the accuracy of period measurements:

a. The aging rate of the 1-Mc standard, which is less than 2 parts in 10^8 per week.

b. The ambiguity of the ±1 count.

c. ± trigger error (for one period, assuming signal to noise ratio of 40 db, this trigger error is 0.3% at rated sensitivity). A general formula for finding the percentage error to be expected under various conditions is as follows:

$$A = 100 \left(\pm \frac{f_2}{nf_1} \pm \frac{e}{n} \pm E \right)$$

A = accuracy in %

f_1 = time base frequency counted (cps)

f_2 = frequency whose period is being measured (cps)

n = number of periods averaged

e = 3×10^{-3} (trigger error for one period, 40 db S/N)

E = time base accuracy (weekly maximum drift rate) E depends on the drift rate of the individual time base, absolute value of off-set at standardization and the time since standardization. A plot of this formula for the 5245L is shown in Figure 3-1.

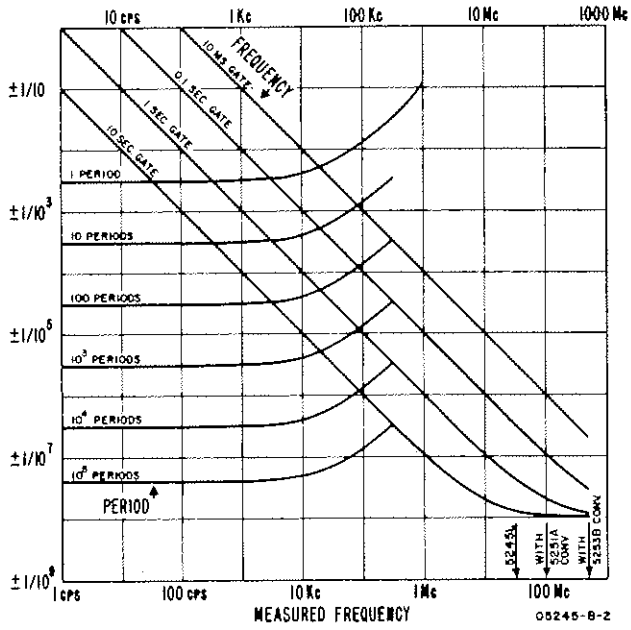


Figure 3-1. Measurement Accuracy

3-8. STANDARD FREQUENCY OUTPUT.

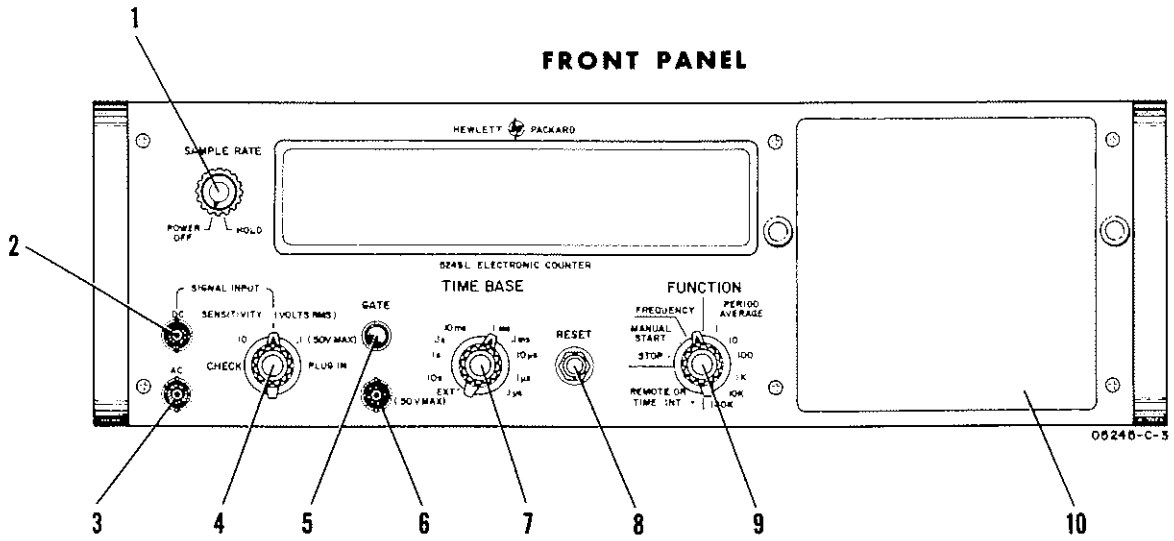
3-9. FRONT PANEL. Frequencies of 0.1 cps to 1 Mc are available in decade steps at the TIME BASE EXT connector as selected by the TIME BASE switch. This output is subject to the restrictions given below in Paragraph 3-11.

3-10. REAR PANEL. Frequencies of 0.1 cps through 10 Mc are available in decade steps at the rear-panel OUTPUT connector as selected by the rear-panel OUTPUT switch. This output is subject to the restrictions listed below.

3-11. RESTRICTIONS. All frequencies are available one at a time in the MANUAL function without interruption; 1 kc is continuously available for all functions except 100K PERIOD AVERAGE; 10 kc to 10 Mc continuously available in all functions.

Note

Accuracy and stability of these outputs is the same as that of the time base oscillator.



1. SAMPLE RATE
   a. Controls power to all circuits except crystal oven heater; max ccw turns POWER OFF.
   b. Controls time between measurements from 0.1 sec to 5 sec.
   c. Causes display to HOLD indefinitely when maximum cw.

2. DC SIGNAL INPUT provides direct coupling to internal amplifier for most measurements.

3. AC SIGNAL INPUT provides coupling to internal amplifier through 1 μf (600 vdc maximum).

4. SIGNAL INPUT SENSITIVITY.
   a. Controls input attenuator; set to highest position which includes signal amplitude (max overload; 50v in position 0.1, 150v in position 1; 500v in position 10).
   b. Maximum CCW (CHECK position) gives internal self check; counts 10 Mc with selected TIME-BASE gate for FREQUENCY; 100 kc for number of periods averaged (10 μsec to 1 sec) for PERIOD AVERAGE, or continuously at selected TIME BASE frequency (0.1 cps to 10 Mc) for MANUAL START.
   c. Maximum CW (PLUG-IN position) connects output of plug-in unit directly to input amplifier.

5. GATE lamp glows during counting (main gate open).

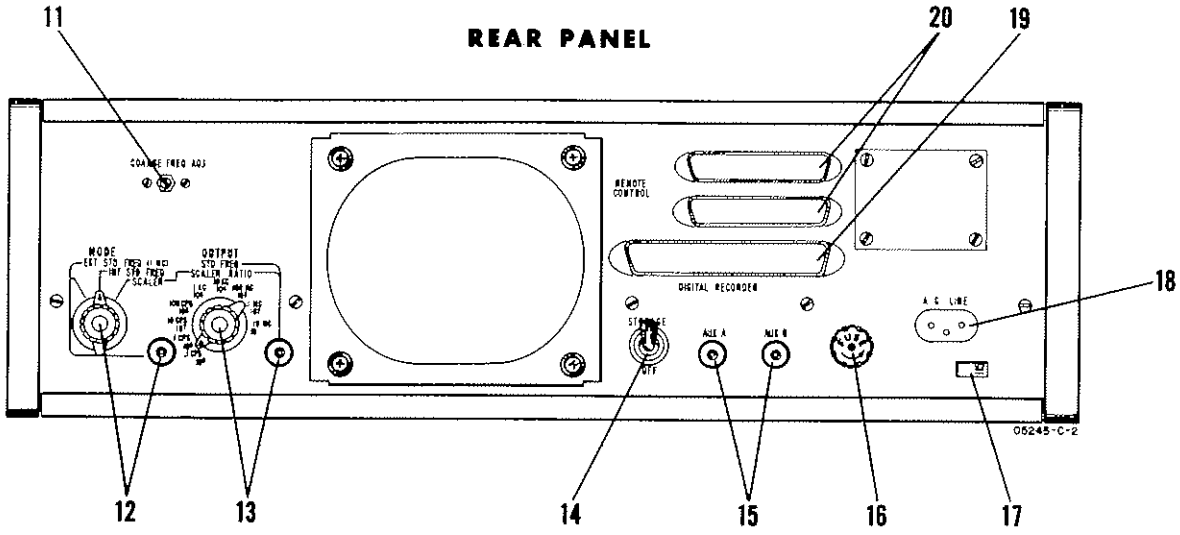
6. EXT connector
   a. Provides input for higher of two frequencies for ratio measurement (lower frequency to SIGNAL INPUT) when TIME BASE set to EXT.
   b. Provides output frequency 0.1 cps to 1 Mc as selected by TIME-BASE switch (see text for restrictions).

7. TIME BASE selects either time that main gate is on for frequency or time unit per count for period measurement.

8. RESET pushbutton returns both displayed and internal count to zero when pressed.

9. FUNCTION
   a. Permits totalizing of pulses applied to SIGNAL INPUT when set to MANUAL START; holds accumulated count when switched to MANUAL stop.
   b. Permits measurement of frequency applied to SIGNAL INPUT during interval selected by TIME-BASE switch when in FREQUENCY.
   c. Permits period measurement of waveforms applied to SIGNAL INPUT averaged over 1 to 100,000 periods when set to PERIOD AVERAGE.
   d. Removes control of TIME-BASE and FUNCTION switches when set to REMOTE or TIME INT; remote control is provided through rear connector or plug-in unit.

Figure 3-2. Operating Controls (Front Panel)



10. Plug-in compartment
    a. Receives plug-in unit to extend basic counter capabilities. To install plug-in (1) turn power off, (2) loosen knurled screws at each side of compartment, (3) remove blank panel or plug-in unit, (4) slide desired plug-in unit into place and tighten knurled screws.
    b. Permits access to fine and medium frequency controls through panel at rear of compartment; FINE FREQ ADJ has range of about 5×10^{-8}; MED FREQ ADJ has range of about 1×10^{-6}.

11. COARSE FREQ ADJ permits adjustment of oscillator over a range of about 1×10^{-5}.

12. MODE
    a. Permits use of external 1-Mc frequency standard for time-base control when set to EXT STD FREQ (1 MC).
    b. Permits normal operation of counter using internal oscillator when set to INT STD FREQ.
    c. Permits scaling of input signal by factors of 10 when set to SCALER.

13. OUTPUT
    a. Supplies selected frequency when MODE is set to INT STD FREQ (see text for restrictions).
    b. Supplies scaled input frequency when MODE is set to SCALER.

14. STORAGE switch provides display storage when up; continuous display of internal count when OFF (down).

15. AUX A/AUX B (TIME INTERVAL TRIGGER OUT - START/STOP). Auxiliary plug-in outputs. See appropriate plug-in manual.

16. Fuse provides overload protection; should be 2 ampere slow-blow for 115-volt operation; 1 ampere slow-blow for 230-volt operation.

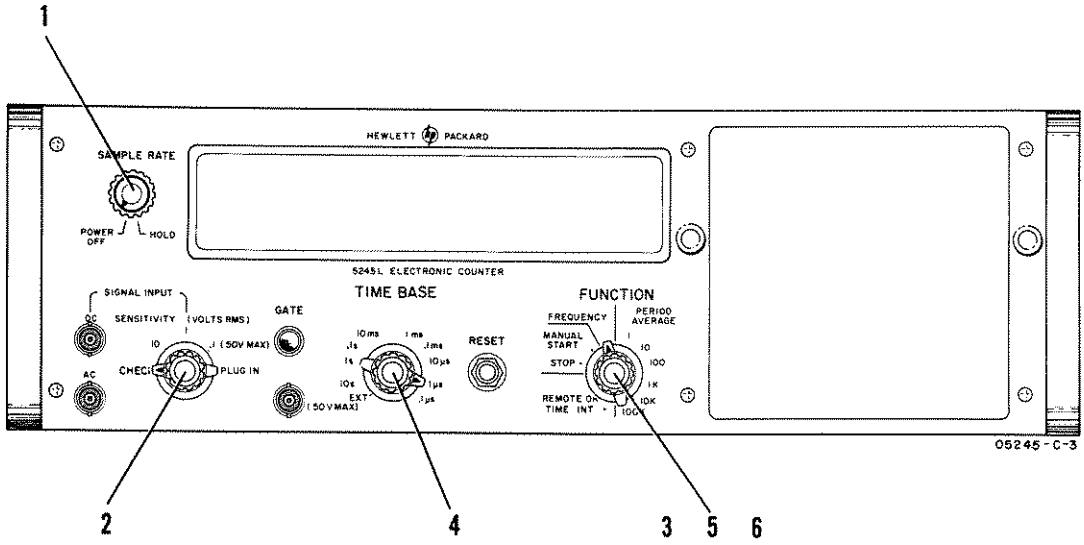
17. Line-voltage switch permits selection of either 115- or 230-vac line; insert narrow blade and slide to left for 115 v, slide to right for 230v.

18. AC LINE connector connects to flat plug on power cable.

19. DIGITAL RECORDER connector supplies BCD information to recorder, analog converter, or data processing equipment.

20. REMOTE CONTROL connectors permit connection to remote location for control of all front-panel switch functions except SENSITIVITY and SAMPLE RATE (see text for details).

Figure 3-3. Operating Controls (Rear Panel)

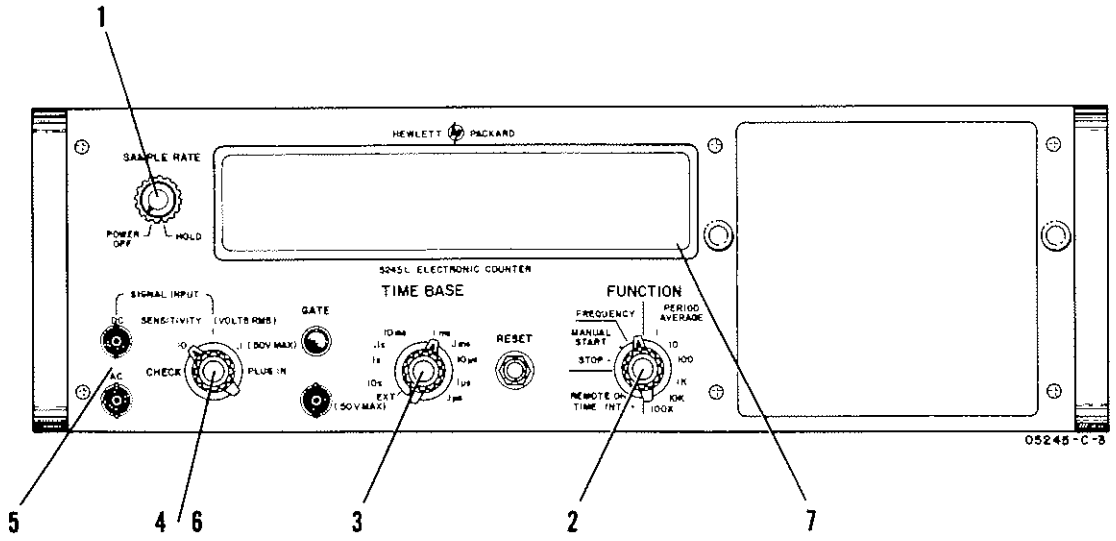


1. Turn SAMPLE RATE control clockwise from POWER OFF position to turn counter on.
2. Set SENSITIVITY switch to CHECK.
3. Set FUNCTION switch to FREQUENCY.
4. See table below for proper display (±1 count) for each position of TIME BASE switch.
5. Set FUNCTION switch to MANUAL START. Counter should count continuously at frequency selected on TIME BASE switch.
6. Set FUNCTION switch to 1 PERIOD AVERAGE.
7. See table below for proper display (±1 count) for each PERIOD AVERAGE position of the FUNCTION switch.

TIME BASE	DISPLAY
1 μs	00000010. Mc
10 μs	0000010.0 Mc
.1 ms	000010.00 Mc
1 ms	00010000. Kc
10 ms	0010000.0 Kc
.1 s	010000.00 Kc
1 s	10000.000 Kc
10 s	0000.0000 Kc

PERIOD AVERAGE	DISPLAY
1	00000001
10	00000010
100	00000100
1K	00001000
10K	00010000
100K	00100000

Figure 3-4. Self Check



1. Turn SAMPLE RATE control clockwise from POWER OFF position to turn counter on.
2. Set FUNCTION switch to FREQUENCY.
3. Set TIME BASE switch for desired count (gate) time.

Note

Asterisk (*) will light at right end of display for switch positions which do not permit legitimate measurement (in this case EXT and .1μs).

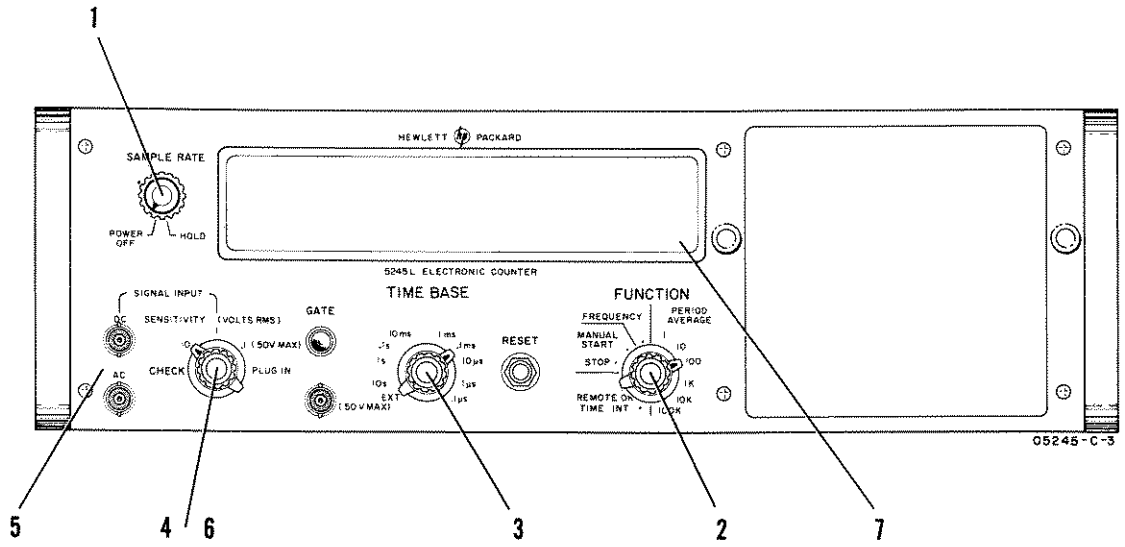
4. Set SENSITIVITY switch to CHECK to verify proper counter operation (see Figure 3-4).
5. Connect unknown signal to AC or DC SIGNAL INPUT jack.
6. Change SENSITIVITY switch to "10". If there is no count, or if count is uncertain, progressively switch SENSITIVITY to lower ranges.

CAUTION

Maximum overload is 50 volts in position 0.1, 150 volts in position 1, 500 volts in position 10. Maximum input level for correct count is 2 volts in position 0.1, 20 volts in position 1, 200 volts in position 10.

7. Read frequency from display. Decimal point is correctly positioned and correct measurement unit (kc or Mc) is displayed.

Figure 3-5. Frequency Measurements



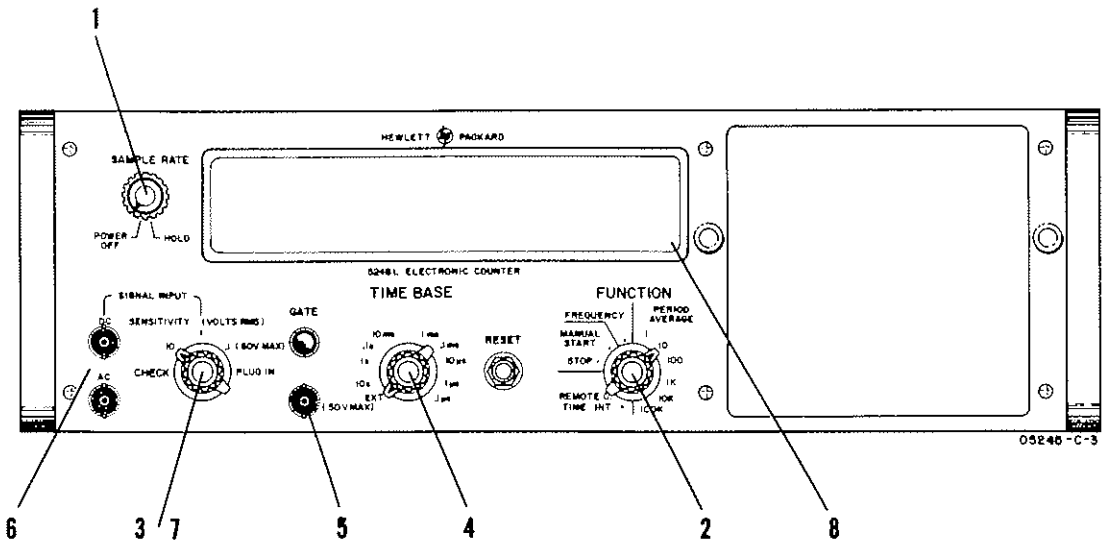
1. Turn counter on with SAMPLE RATE control.
2. Set FUNCTION switch to desired PERIOD AVERAGE position.
3. Set TIME BASE switch to desired time unit per count.

Note

Asterisk (*) will light at right end of display for switch positions which do not permit legitimate measurement (in this case may be any position between 1 millisecond and 10 seconds, depending on number of periods averaged as selected on FUNCTION switch).

4. Set SENSITIVITY switch to CHECK to verify proper counter operation (see Figure 3-4).
5. Connect unknown signal to AC or DC SIGNAL INPUT jack.
6. Turn SENSITIVITY switch clockwise to first position which gives steady count. (See CAUTION, Figure 3-5.)
7. Read period from display. Decimal point is correctly positioned and measurement unit (μs, ms, sec) is displayed.

Figure 3-6. Period Measurements



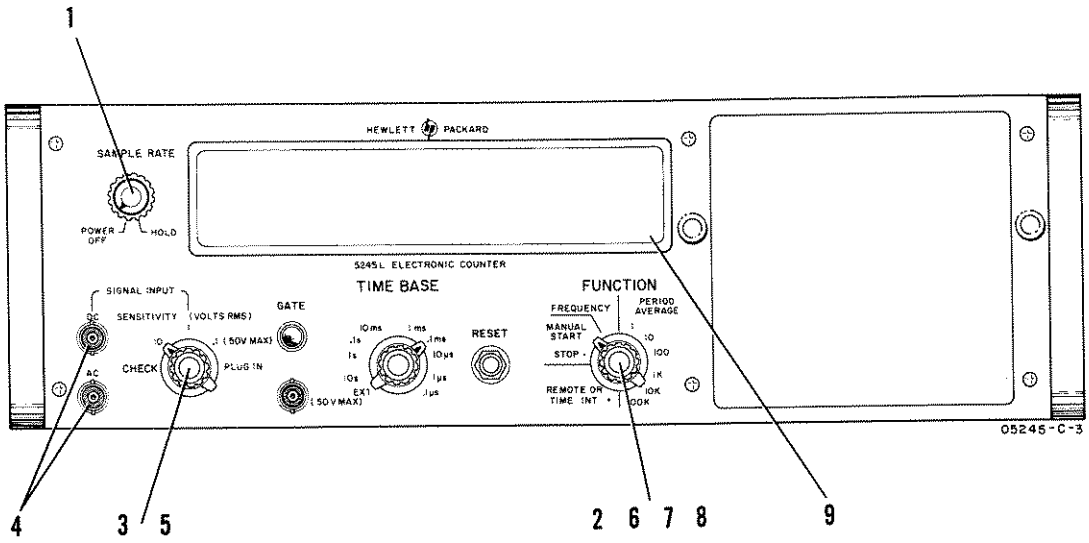
Proceed as follows to measure the ratio between two frequencies (f_1/f_2). The higher frequency (f_1) may be between 0 and 50 mc; the lower frequency (f_2) must be less than 1 Mc for single period measurement and less than 300 kc for multiple-period measurement.

1. Turn counter on with SAMPLE RATE control.
2. Set FUNCTION switch to desired PERIOD AVERAGE position.
3. Set SENSITIVITY switch to CHECK to verify proper counter operation (see Figure 3-4).
4. Set TIME BASE switch to EXT.
5. Connect f_1 (the higher frequency) to the TIME BASE EXT connector.

   CAUTION

   Input f_1 must not exceed 2 volts for correct count. Maximum input 50 volts rms.
6. Connect f_2 (the lower frequency) to the AC or DC SIGNAL INPUT jack.
7. Turn SENSITIVITY switch clockwise to first position which gives steady count. (See CAUTION, Figure 3-5.)
8. Read ratio f_1/f_2 from display. Decimal point is correctly positioned, but no measurement unit is given since ratio is dimensionless.

Figure 3-7. Ratio Measurements



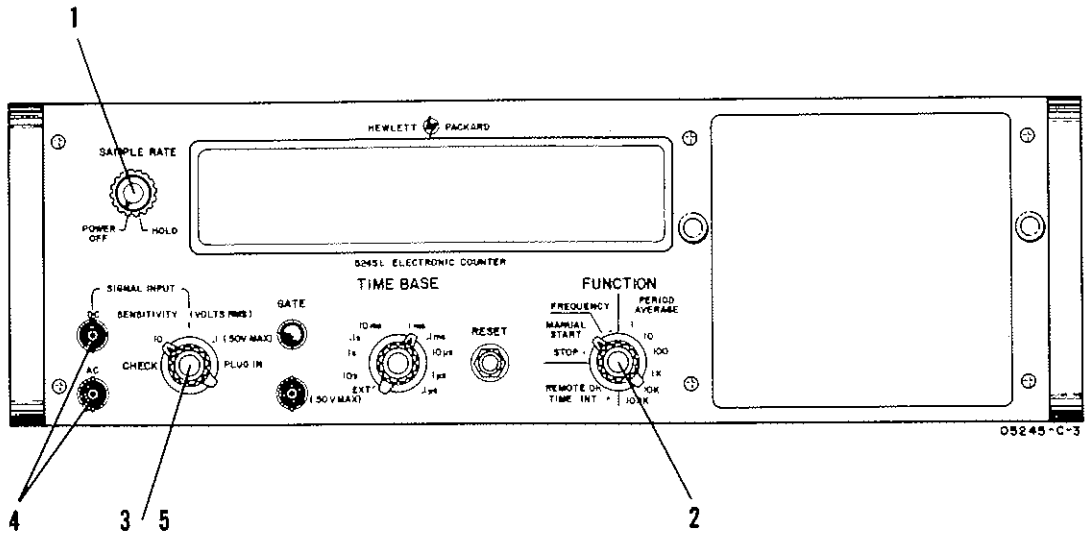
1. Turn counter on at SAMPLE RATE control.
2. Set FUNCTION switch to MANUAL START.
3. To verify correct counter operation, set SENSITIVITY switch to CHECK. Counter should count continuously at frequency selected on TIME BASE switch.
4. Connect signal to AC or DC SIGNAL INPUT jack.
5. Change SENSITIVITY switch to "10". If there is no count, or if count is uncertain, progressively switch SENSITIVITY to lower ranges. (See CAUTION, Figure 3-5.)

CAUTION

Maximum overload is 50 volts in position 0.1, 150 volts in position 1, 500 volts in position 10.

6. Set FUNCTION switch to MANUAL STOP.
7. At desired time to begin count, set FUNCTION switch to MANUAL START.
8. At desired time to stop count, set FUNCTION switch to MANUAL STOP.
9. Read accumulated count from display.

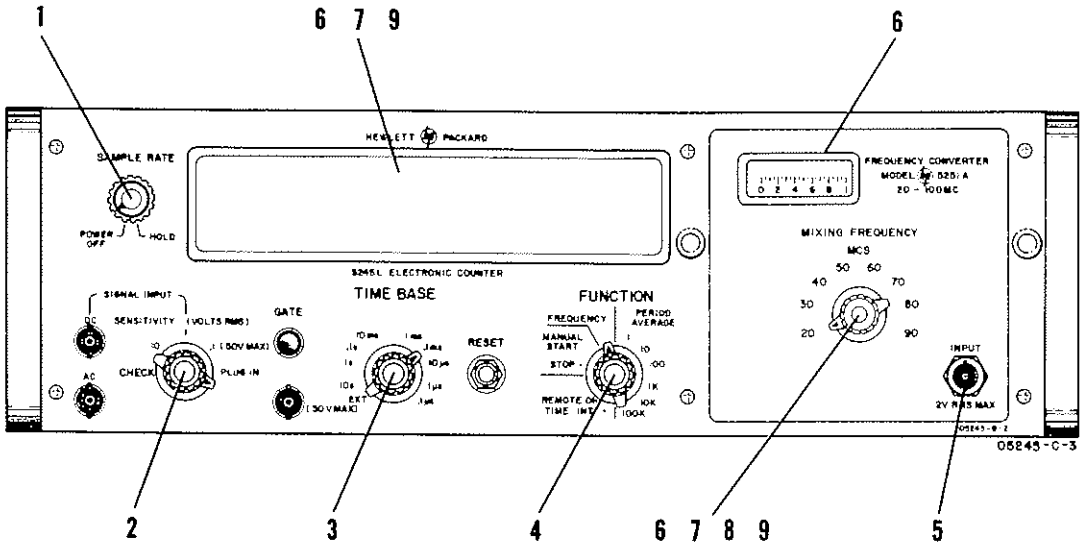
Figure 3-8. Totalizing Operation



Any signal from 0 to 50 Mc can be scaled by decade factors from 10 to 10^9. Proceed as follows.

1. Turn counter on at SAMPLE RATE control.
2. Set FUNCTION switch to MANUAL START.
3. Set SENSITIVITY switch to CHECK. Counter should count continuously at frequency selected on TIME BASE switch.
4. Connect signal to AC or DC SIGNAL INPUT jack.
5. Turn SENSITIVITY switch clockwise to first position which gives steady count. (See CAUTION, Figure 3-5.)
6. Set OUTPUT switch (rear panel) to desired scaler ratio (10 to 10^9).
7. Take scaled output from OUTPUT connector located below the OUTPUT switch.

Figure 3-9. Scaler Operation

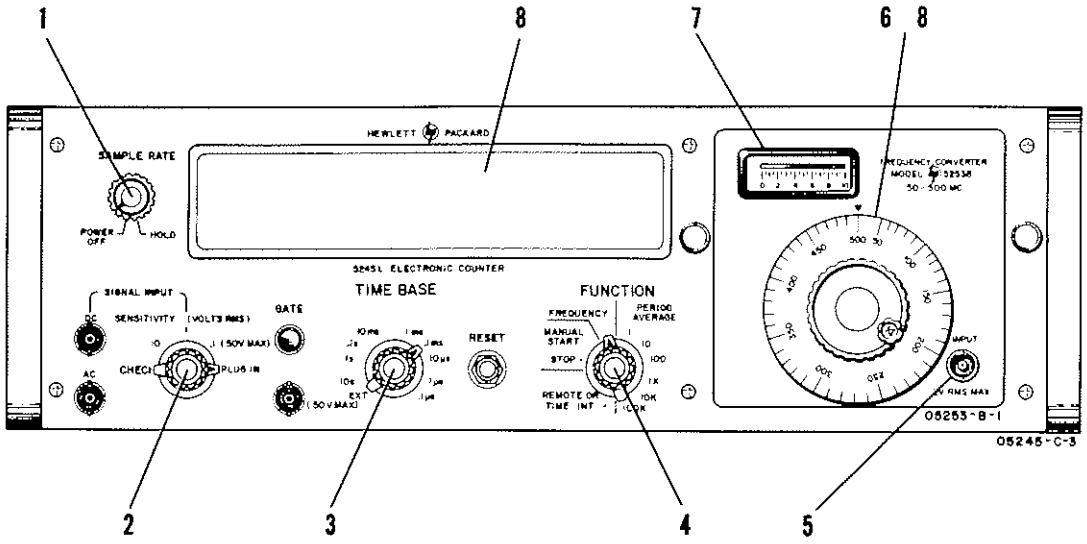


1. Turn counter on at SAMPLE RATE control.
2. Set SENSITIVITY to PLUG-IN.
3. Set counter TIME-BASE for desired gate-on time.
4. Set FUNCTION to FREQUENCY.
5. Connect signal whose frequency is to be measured to converter INPUT. DO NOT EXCEED 2 VOLTS RMS. Input impedance approximately 50 ohms.
6. Set MIXING FREQUENCY to 50 Mc. If meter indicates in green area and counter reading is less than 11 Mc, proceed with step 7. If meter does not indicate in green area or if counter reading is greater than 11 Mc, increase MIXING FREQUENCY in 10-Mc steps until meter indicates in green area and counter reading is less than 11 Mc.
7. Add counter reading to MIXING FREQUENCY for frequency of INPUT signal.
8. Increase MIXING FREQUENCY by 10 MC.
9. Subtract counter reading from MIXING FREQUENCY; result should agree with frequency obtained in step 7.

Note

Meter may indicate in red area and proper counter reading may not be displayed when MIXING FREQUENCY differs from frequency of INPUT signal by less than 100 kc. See Operating and Service manual for Model 5251A Frequency Converter.

Figure 3-10. Model 5251A, 100 Mc Frequency Converter



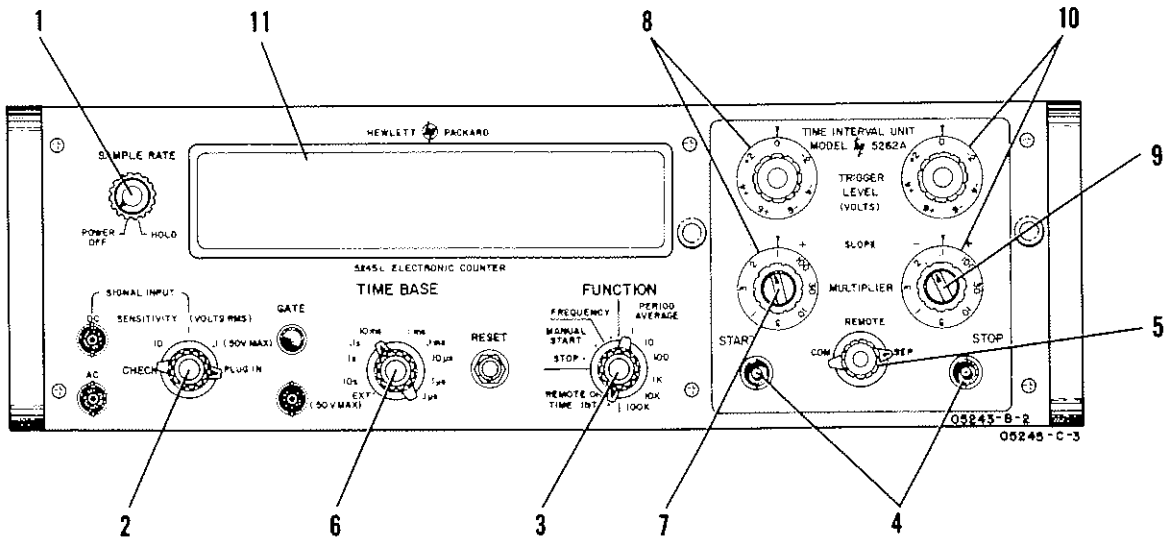
1. Turn counter on at SAMPLE RATE control.
2. Set SENSITIVITY to PLUG IN.
3. Set counter TIME BASE for desired gate-on time.
4. Set FUNCTION to FREQUENCY.
5. Connect signal whose frequency is to be measured to INPUT of converter.

   CAUTION

   Do not exceed 2 volts rms. Input impedance approximately 50 ohms.

6. Set mixing frequency control to read slightly less than 50 Mc.
7. Slowly turn mixing frequency control counterclockwise until level indicator meter first reaches a maximum reading in the green portion of its scale. Dial should not be set between minor division marks.
8. Add counter display (in Mc) to mixing frequency control reading (in Mc) for frequency of INPUT signal.

Figure 3-11. Model 5253B, 500 Mc Frequency Converter



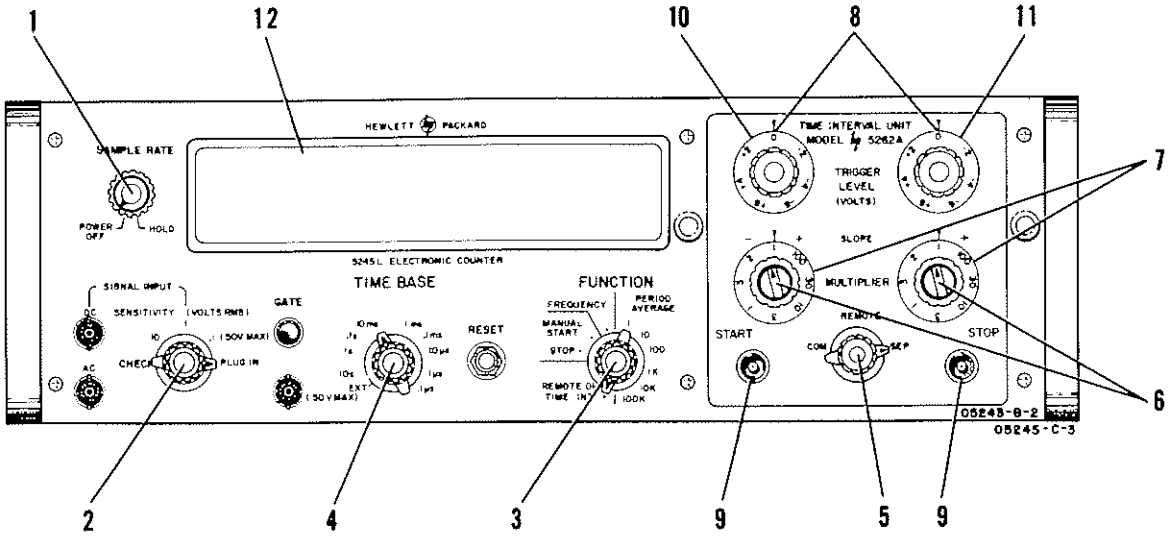
1. Turn counter on at SAMPLE RATE control.
2. Set SENSITIVITY switch to PLUG-IN.
3. Set FUNCTION switch to REMOTE OR TIME INT.
4. Connect signal to START or STOP with selector at common, to START and STOP at other positions of selector switch. See Operating and Service Manual for Model 5262A Time Interval Unit for restrictions.
5. Set COM-REMOTE-SEP to:
   a. COM if start and stop signals are from the same source.
   b. SEP if start and stop signals are from different sources.
   c. REMOTE if the Model 5245L is being operated from a remote control box.
6. Set TIME BASE switch to obtain count consistent with measurement resolution required, or to EXT if an external time unit is used.
7. Set start channel SLOPE control to "+" if you want measurement to start on positive slope. Set to "-" if you want to start count on negative slope.
8. Adjust start MULTIPLIER and TRIGGER LEVEL controls to set measurement start point at desired voltage level.
9. Set stop channel SLOPE control to "+" if you want measurement to stop on positive-going part of signal. Set to "-" if you want to stop count on negative slope.
10. Adjust stop MULTIPLIER and TRIGGER LEVEL controls to set measurement stop points at desired voltage level.

Note

Connect oscilloscope to AUX A or AUX B output (rear panel) to observe start or stop setting.

11. Read time interval units.

Figure 3-12. Model 5262A, Time Interval Unit

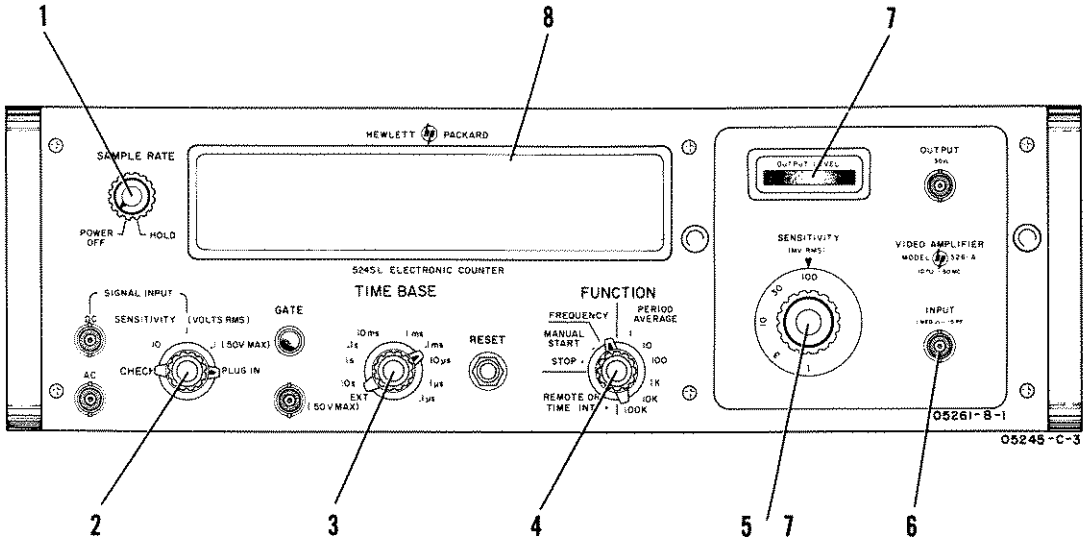


1. Turn counter on at SAMPLE RATE control.
2. Set SENSITIVITY to PLUG IN.
3. Set FUNCTION to REMOTE OR TIME INT.
4. Set TIME BASE switch to obtain greatest possible count, or to EXT if an External Frequency is counted.
5. Set COM-REMOTE-SEP to SEP.
6. Set start and stop TRIGGER SLOPE to same polarity.
7. Set both START and STOP MULTIPLIER controls to 0.1 position.
8. Set both start and stop TRIGGER LEVEL controls to 0 position.
9. Connect signals whose phase difference is to be measured to START and STOP inputs. (Note: for specified accuracy, do not exceed ± 40 volts peak times multiplier setting.)
10. Set start TRIGGER LEVEL control for no difference in counter reading as start MULTIPLIER is switched between the 0.1 and 0.2 positions. Procedure:
    a. Note counter reading with MULTIPLIER set to 0.1 position.
    b. Note counter reading with MULTIPLIER set to 0.2 position.
    c. Subtract the smaller reading from the larger reading.
    d. If reading in step b is less than reading in step a, add result of step c to reading of step a and adjust TRIGGER LEVEL for result.
    e. If reading in step b is greater than reading in step a, subtract result of step c from reading of step a and adjust TRIGGER LEVEL for result.

    Note

    The procedure may have to be repeated to obtain exact zero crossing.
11. Repeat step 10 for stop TRIGGER LEVEL control.
12. Read phase difference in units selected by TIME BASE switch.

Figure 3-13. Ⓐ Model 5262A, Phase Measurement



1. Turn counter on at SAMPLE RATE control.
2. Set SENSITIVITY to PLUG IN.
3. Set counter TIME BASE as desired.
4. Set FUNCTION as desired.
5. Set Video Amplifier SENSITIVITY to 100 MV.
6. Connect signal whose frequency is to be measured to INPUT connector on Video Amplifier. DO NOT EXCEED 5 V RMS.
7. Vary Video Amplifier SENSITIVITY control until Level Indicator Meter reads in the green portion of its scale.
8. Frequency of INPUT signal is displayed by counter.

Figure 3-14. Model 5261A, Video Amplifier

3-12. PLUG-IN UNITS.

3-13. Operating and Service manuals are available for each plug-in unit. These manuals provide complete operating and maintenance procedures, specifications, and limitations for the plug-in units. To install plug-in units:

a. Turn counter power off.

b. Loosen knurled screws at each side of plug-in compartment (counterclockwise).

c. Remove blank panel or plug-in unit.

d. Slide desired plug-in unit into place.

e. Tighten knurled screws (clockwise).

3-14. DIGITAL RECORDER OUTPUT.

3-15. To supply counter display information (including all digits, decimal point position, and measurement unit) to the ℔Model 562A Digital Recorder or ℔Model 580A/581A Digital-to-Analog Converter, just connect 50-wire cable (℔ stock no. 562A-16C) between rear-panel DIGITAL RECORDER jack on counter and input connector of recorder or converter. Cable can be fabricated for connection to other equipment using an Amphenol 57-30500 connector to mate with the counter DIGITAL RECORDER jack. Signals available and external signals required are given in Table 3-1. Tables 3-2 and 3-3 provide output information for decimal point and measurement units recording.

Table 3-1. Summary of Connections to Digital Recorder Jack

Function		J11 Pin No.	Function		J11 Pin No.
Display	Weight		Display	Weight	
(Right End) 10^0 Units	1 2 2 4	1 2 26 27	Measurement Units	1 2 2 4	17 18 42 43
10^1 Tens	1 2 2 4	3 4 28 29	Decimal Point Position	1 2 2 4	19 20 44 45
10^2 Hundreds	1 2 2 4	5 6 30 31	Inhibit signal input; +15v min, +25 v max supplied from external source to prevent reset; causes count to hold		22
10^3 Thousands	1 2 2 4	7 8 32 33	Print command output; +13 v to 0 v step, DC-coupled, signals that completed count is available for readout		48
10^4 Ten Thousands	1 2 2 4	9 10 34 35	Neg reference output; about -6.5 vdc indicates "0" level for BCD output		24
10^5 Hundred Thousands	1 2 2 4	11 12 36 37	Pos reference output; about +17 vdc indicates "1" level for BCD output		25
10^6 Millions	1 2 2 4	13 14 38 39	Ground		50
(Left End) 10^7 Ten Millions	1 2 2 4	15 16 40 41	No connection		21 23 46 47 49

Table 3-2. Decimal Point BCD Out

DISPLAY	J11 Output (Volts)				Printed Digit
	Pin 45	Pin 44	Pin 20	Pin 19	
0 0 0 0 0 0 0 0	- 8	- 8	- 8	- 8	0
0 0 0 0 0 0 0 0.	- 8	- 8	- 8	- 8	0
0 0 0 0 0 0 0. 0	- 8	- 8	- 8	+18	1
0 0 0 0 0 0. 0 0	- 8	- 8	+18	- 8	2
0 0 0 0 0. 0 0 0	- 8	- 8	+18	+18	3
0 0 0 0. 0 0 0 0	- 8	+18	+18	- 8	4
0 0 0. 0 0 0 0 0	- 8	+18	+18	+18	5
0 0. 0 0 0 0 0 0	+18	+18	- 8	- 8	6
0. 0 0 0 0 0 0 0	+18	+18	- 8	+18	7

Table 3-3. Measurement Units BCD Out

DISPLAY	J11 Output (Volts)				Printed Digit
	Pin 43	Pin 42	Pin 18	Pin 17	
*	- 8	- 8	- 8	- 8	0
MC	- 8	- 8	- 8	+18	1
KC	- 8	- 8	+18	- 8	2
SEC	- 8	- 8	+18	+18	3
MS	- 8	+18	+18	- 8	4
μS	- 8	+18	+18	+18	5

3-16. REMOTE CONTROL.

3-17. OPERATION. Front-panel controls at the counter should normally be set as follows to allow remote control.

a. FUNCTION: REMOTE OR TIME INTERVAL.

b. TIME BASE: EXT.

c. SENSITIVITY: Not CHECK, set to proper range for input signal amplitude.

d. SAMPLE RATE: as desired.

Note

To permit normal front-panel control, all remote control circuit connections must be interrupted.

3-18. GENERAL. Two rear-panel connectors permit connection for complete control of the basic instrument from a remote location. All front-panel switching operations can be controlled except for SAMPLE RATE and SENSITIVITY.

3-19. PROGRAMMING. The following procedure describes how to provide counter control from a remote location. All that is required is contact closure between appropriate terminals of J9 and J10 on the rear panel. Mating connector for J9 or J10 is Amphenol 57-40360.

a. Program desired FUNCTION by connecting -15 volts to J9 pins listed in Table 3-4. When counter is on, -15 volts is continuously available at pin 30 of J9; -15 volts is also available at pin 32 of J10 only when FUNCTION switch is set to REMOTE OR TIME INT.

Table 3-4. Function Program

Equivalent Switch Position	Pins on J9 Requiring -15V
MANUAL START	2, 15
MANUAL STOP	2, 14
FREQUENCY	2, 3, 12
1 PERIOD AVERAGE	1, 5, 12
10 PERIOD AVERAGE	1, 11, 13, 5
100 PERIOD AVERAGE	1, 10, 13, 5
1K PERIOD AVERAGE	1, 9, 13, 5
10K PERIOD AVERAGE	1, 8, 13, 5
100K PERIOD AVERAGE	1, 7, 13, 5

b. Program desired TIME BASE by connecting -15 volts to J9 pins listed in Table 3-5.

Table 3-5. Time-Base Program

Equivalent Switch Position	Pins on J9 Requiring -15V
10 s	21
1 s	22
.1 s	23
10 ms	24
1 ms	25
.1 ms	26
10 μs	27
1 μs	28
.1 μs	29

c. Counter operation may be programmed for CHECK, if desired, by connecting -15 volts to the J9 pins listed in Table 3-6.

d. Program appropriate decimal point and measurement unit for the selected FUNCTION and TIME BASE by connecting +170 V to J10 pins as given in Table 3-7. When counter is on, +170 volts is continuously available at pin 20 of J10; +170 volts is also available at pins 21 and 22 of J10 when FUNCTION switch is set to REMOTE OR TIME INTERVAL.

Table 3-6. Check Program

Check Function	Pins on J9 Requiring -15V
MANUAL	1, 15, any 21-29
FREQUENCY	3, 6, 12, any 21-28
1 PERIOD AVERAGE	1, 3, 12, 27
10 PERIOD AVERAGE	1, 3, 11, 13, 27
100 PERIOD AVERAGE	1, 3, 10, 13, 27
1K PERIOD AVERAGE	1, 3, 9, 13, 27
10K PERIOD AVERAGE	1, 3, 8, 13, 27
100K PERIOD AVERAGE	1, 3, 7, 13, 27

Table 3-7. Pins on J10 Requiring +170 V for Decimal Point and Measurement Units Program

Function	Time Base									
	0.1 μs	1 μs	10 μs	0.1 ms	1 ms	10 ms	0.1 ms	1 s	10 s	EXT
MANUAL START	-	-	-	-	-	-	-	-	-	-
MANUAL STOP	-	-	-	-	-	-	-	-	-	-
FREQUENCY	11	10, 13	1, 13	2, 13	10, 12	1, 12	2, 12	3, 12	4, 12	11
1 PERIOD AVERAGE	1, 16	10, 16	2, 15	1, 15	10, 15	2, 14	1, 14	10, 14	11	10
10 PERIOD AVERAGE	2, 16	1, 16	10, 16	2, 15	1, 15	10, 15	2, 14	1, 14	11	1
100 PERIOD AVERAGE	3, 16	2, 16	1, 16	10, 16	2, 15	1, 15	10, 15	11	11	2
1K PERIOD AVERAGE	4, 16	3, 16	2, 16	1, 16	10, 16	2, 15	11	11	11	3
10K PERIOD AVERAGE	5, 16	4, 16	3, 16	2, 16	1, 16	11	11	11	11	4
100K PERIOD AVERAGE	6, 16	5, 16	4, 16	3, 16	11	11	11	11	11	5

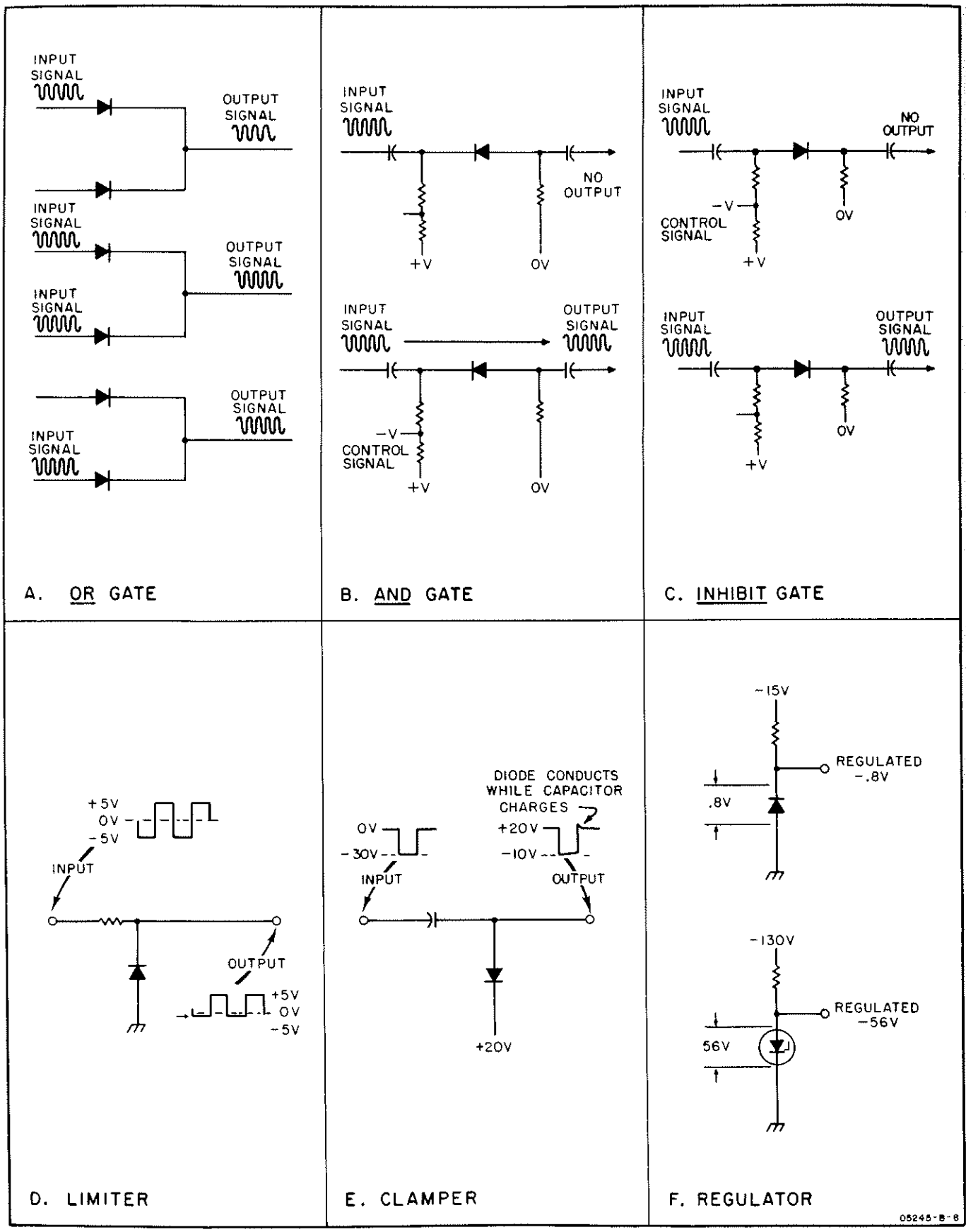


Figure 4-1. Basic Diode Circuits

SECTION IV
PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section describes how the Model 5245L operates. Basic circuits used in the counter are described first (Paragraphs 4-3 through 4-22). Operation of decimal counters and decade dividers is thoroughly discussed in Paragraphs 4-23 through 4-33. A discussion of basic counter functions is given next (Paragraphs 4-34 through 4-41). Pulse timing circuits and overall operation of the entire counter are discussed in Paragraphs 4-42 through 4-48. At the end of the section each assembly is described in order of its assembly designation (A__) (Paragraphs 4-49 through 4-120).

4-3. THE DIODE.

4-4. GENERAL. Semiconductor diodes are used in signal-handling circuits and in power supply rectifier and regulator circuits.

4-5. THE "OR" GATE. Two or more diodes are sometimes used as an OR gate. The OR gate is a multiple-input circuit which requires only one input to produce an output. Figure 4-1A shows some OR gate configurations.

4-6. THE "AND" GATE. The AND gate or coincidence circuit is a multiple-input circuit which requires the presence of all input signals to produce an output. Figure 4-1B shows an AND gate configuration in which an input signal is passed only when a properly polarized control voltage is applied.

4-7. THE "INHIBIT" GATE. The signal normally passes through an INHIBIT gate; adding a second signal closes the gate and prevents the signal from going through. One of the most common forms of the INHIBIT gate is the series gate shown in Figure 4-1C. If the diode is biased off, the gate is closed, and pulses do not reach the decade divider or decimal counter; when the diode is biased on, the pulses go through the gate and reach the decade divider or decimal counter.

4-8. LIMITER OR CLIPPER. The limiter or clipper is a circuit which removes positive or negative peaks of waveforms. It can be used either as a waveform shaping circuit or as a protective device to prevent excessive voltages from reaching a sensitive circuit. Figure 4-1D shows a limiter which prevents the negative peak of a pulse from going more negative than about -0.6 volt. Note that for a conducting silicon diode the cathode voltage is about 0.6 to 0.8 volt more negative than the anode.

4-9. CLAMPER OR DC RESTORER. The clamper or DC restorer is a circuit which establishes either the positive or negative peak of a waveform at a particular DC reference voltage; in other words, it provides a definite baseline voltage for the waveform. Figure 4-1E shows a clamper which provides a baseline of about +20 volts for a negative pulse.

4-10. REGULATOR. A diode regulator uses either the constant reverse-bias breakdown voltage characteristic of a breakdown diode or the constant forward-bias voltage drop characteristic of a silicon diode. Power supply reference voltages are generally provided by breakdown diodes which maintain a constant voltage when supplied with a reverse-bias voltage greater than their specified breakdown voltage. Regulated voltages can also be provided by a forward-biased silicon diode which maintains a constant 0.6 to 0.8 volt drop. Figure 4-1F shows connections for both types of diodes.

4-11. THE TRANSISTOR.

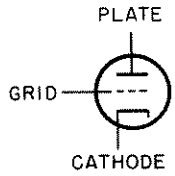
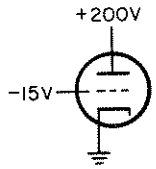
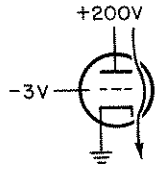
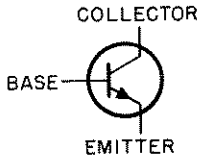
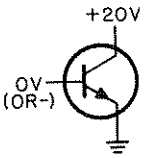
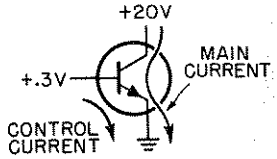
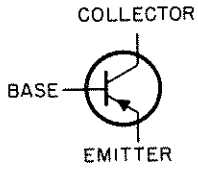
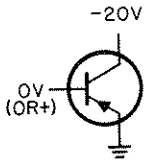
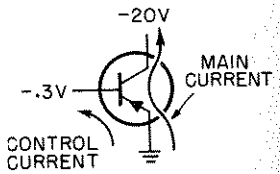
4-12. GENERAL. Transistors are used throughout the counter in circuit configurations such as the amplifier, the flip-flop or binary, the trigger circuit, and the one-shot multivibrator. In the following paragraphs, basic transistor operation and a few basic transistor circuits are discussed. These paragraphs discuss the easily observed changes in currents and voltages in transistor circuits which help technicians locate circuit faults but do not attempt to describe how transistors work internally.

4-13. BIASING AND CONDUCTION. Vacuum tubes and transistors are functionally similar. In the tube a small grid-to-cathode voltage controls a larger plate-to-cathode current flow. In a transistor a small base-to-emitter current controls a large collector-to-emitter current. A comparison of basic vacuum tube, NPN transistor, and PNP transistor operation is shown in Figure 4-2A; indicated current represents conventional flow of positive charges external to the transistor and is not intended to indicate flow of carriers inside the transistor structure. Notice that the effect of emitter-base-collector voltages is totally reversed between NPN and PNP transistors; circuits which are arranged for an NPN transistor usually function normally for a PNP transistor if supply voltages are reversed.

4-14. AMPLIFIERS. As with vacuum tubes, three basic amplifier types are available (Figure 4-2B). These amplifiers may be used alone or in combination to form complex circuits.

4-15. FLIP-FLOP. The flip-flop is a bi-stable two-transistor circuit in which one transistor conducts, holding the other cut off. Each input pulse causes a reversal of states; that is, the cut off transistor is turned on and the conducting transistor is cut off. In the flip-flop shown in Figure 4-3A, Q1 is initially conducting heavily; its collector voltage is only slightly negative; a near-zero voltage is supplied to the base of Q2 (junction of R27-28 divider). The voltage drop across R24 produces a sufficiently negative voltage at the emitter of Q2 to hold Q2 cut off. With Q2 cut off the R18-R19-R20 divider delivers a negative voltage to the base of Q1 to keep it conducting.

A. TRANSISTOR BIASING

DEVICE	SYMBOL	CUTOFF	CONDUCTING
VACUUM TUBE			
N P N TRANSISTOR			
P N P TRANSISTOR			

B. AMPLIFIER CHARACTERISTICS

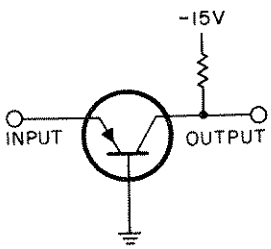
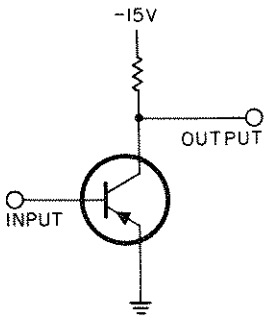
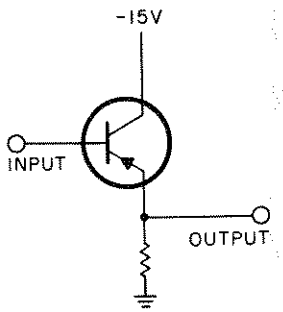
CHARACTERISTIC	COMMON BASE	COMMON EMITTER	COMMON COLLECTOR
INPUT Z	30-50 Ω	500-1500 Ω	20-500K Ω
OUTPUT Z	300-500K Ω	30-50K Ω	50-1000 Ω
VOLTAGE GAIN	500-1500	300-1000	<1
CURRENT GAIN	<1	25-50	25-50
POWER GAIN	20-30 db	25-40 db	10-20 db
			

Figure 4-2. Transistor Operation

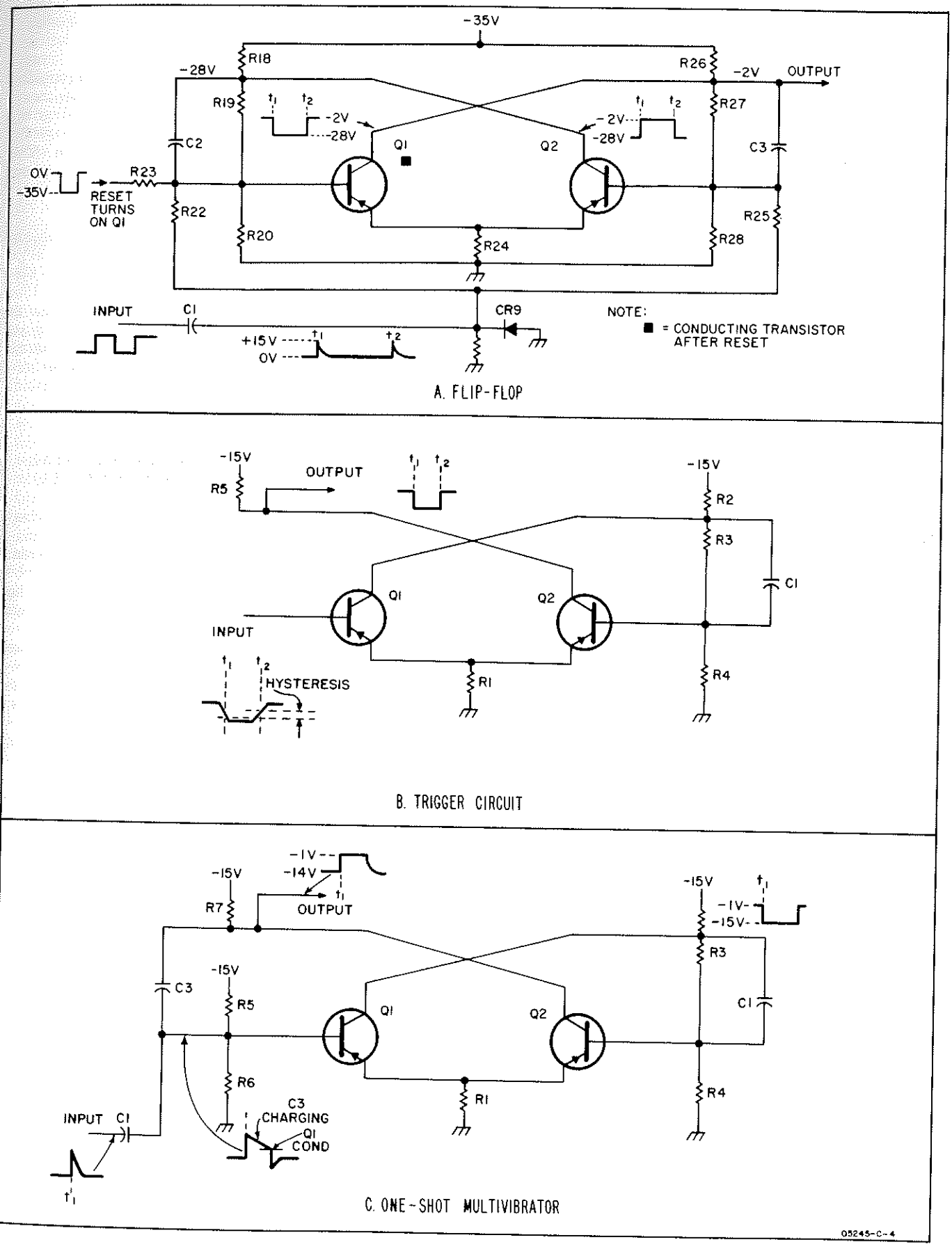


Figure 4-3. Basic Transistor Circuits

4-16. At time t_1 the positive input pulse cuts off Q1; the Q1 collector voltage goes negative and drives Q2 into conduction (R27-R28 divider to Q2 base); the Q2 collector voltage and the Q1 base voltage (R19-R20 divider) then become considerably less negative, permitting Q1 to remain cut off. The R26-R27-R28 divider delivers a sufficiently negative voltage to the base of Q2 to drive it into conduction. In a similar manner the positive input pulse at time t_2 cuts off Q2 and starts a sequence of events which ends with Q1 conducting and Q2 cut off. Note that a positive input pulse has no effect on Q1 if it is already cut off. A negative reset pulse applied to the base of Q1 returns the flip-flop to its initial condition (Q1 conducting, Q2 cutoff). The diode CR9 removes the negative pulse from the differentiated square wave input. Without this diode, the negative pulse would drive Q1 which is cut off and the stage would switch from one state to the other but would not divide by two. The AC coupling through C2 and C3 insures fast switching. The DC coupling through R19 and R27 insures bistable characteristics.

4-17. BINARY CIRCUIT. In this manual a flip-flop which completes its operating cycle and produces an output pulse after receipt of two similar input pulses is called a binary circuit, since it is a counting device in a binary system. The binary circuit is driven from a single input which is connected either through a pair of resistors or through a pair of gating diodes to each transistor base.

4-18. TRIGGER CIRCUIT. The trigger circuit is a limiter or squaring circuit which produces an output waveform with very fast rise and fall times. The trigger circuit is similar to the flip-flop except that the RC network in one half is replaced by the input signal. Capacitor C1 bypasses R3 to couple fast changes in voltage at the Q1 collector to the base of Q2. Either Q1 or Q2 can conduct depending on the voltage at the input. Note that there is a slight difference in input voltage (called hystersis) between switching with a negative-going input (time t_1) and switching with a positive-going input (time t_2).

4-19. ONE-SHOT MULTIVIBRATOR. The one-shot multivibrator is a circuit which generates a pulse of some specified duration following the application of a suitable triggering pulse. The circuit is similar to the flip-flop except one DC coupling path has been removed so the circuit is stable only in the state with Q1 conducting.

4-20. In the typical one-shot multivibrator shown in Figure 4-3C the following conditions exist during the initial stable period: the R5-R6 divider delivers a sufficiently negative potential to the base of Q1 to hold Q1 in saturation; the Q1 collector and Q1 emitter are therefore slightly negative; the R3-R4 divider delivers the Q2 base an even smaller negative voltage to hold Q2 cut off.

4-21. The positive triggering pulse at time t_1 reduces conduction of Q1; the resulting negative-going voltage at the Q1 collector is applied to the Q2 base through the R3-R4 divider (C2 bypasses R3 to provide coupling for the rapidly changing voltage at the Q1 collector); Q2 begins to conduct; the resulting positive-going change in Q2 collector voltage is coupled through C3 to the Q1 base to further decrease Q1 conduction. The process is regenerative and quickly results in Q1 being cut off and Q2 being saturated.

4-22. Capacitor C3 now charges at a rate mainly determined by the values of R6 and C3 (main charge path: R1-Q2-C3-R5). When the Q1 base voltage becomes sufficiently negative, Q1 begins conduction; the resulting positive-going Q1 collector voltage is coupled to the Q2 base; the Q2 collector voltage goes negative and is coupled through C3 to the Q1 base to further increase Q1 conduction. The process is regenerative and ends with the circuit in its original quiescent state, Q1 saturated and Q2 cut off.

4-23. BASIC OPERATION OF DECIMAL COUNTER OR DECADE DIVIDER

4-24. INTRODUCTION. Operation of the decimal counter circuit and the decade divider circuit is similar. The difference between the two is in function. Decimal counter circuits divide the input signal by 10 and actuate the digital display tubes, whereas the decade divider circuits are used to divide the input signal or the output of the internal oscillator into the frequencies to be counted or frequencies to provide the various gate times. Throughout the following discussion, circuits are referred to as "counters" though the description applies equally to decade dividers. Paragraphs 4-25 through 4-29 cover general operation of the counters with emphasis on counting logic; Paragraphs 4-30 through 4-32 discuss readout circuits; and Paragraphs 4-73 through 4-86 discuss specific decimal counter assemblies and the readout assembly.

4-25. INPUT AND OUTPUT FROM BINARY. Figures 4-4A and 4-4B show a flip-flop connected for operation as a binary circuit (basic flip-flop operation is discussed in Paragraphs 4-15 and 4-16). Positive input pulses go to the bases of both transistors and cause switching by cutting off the conducting transistor. Negative reset pulses go to the base of one transistor and turn it on. Note the letter "A" near one transistor and "$\overline{A}$" (read as "A bar" or "not A") near the other. The positive-going transition at the collector of the $\overline{A}$ transistor (while switching from A conducting to $\overline{A}$ conducting) provides the input to the next binary circuit.

4-26. CIRCUIT ARRANGEMENT AND COUNT NOTATION. Figure 4-4C is a block diagram of a typical four-binary decimal counter. Notice that the $\overline{B}$ output is applied to the D, $\overline{D}$, and $\overline{C}$ transistors and that the $\overline{D}$ output is applied only to the C transistor. Each input pulse produces a different combination of conducting and cut-off stages; there are only 10 allowable combinations and each combination represents a

decimal digit. Decimal weighting is the decimal value assigned, arbitrarily, to the output of a pair when the plain-letter transistor is conducting.

a. Decimal Count. Decimal weighting used in the Model 5245L counter is shown in Figure 4-4C, immediately above each of the four binary stages. The decimal weight each pair represents is present only when the plain-letter side (A, B, D, or C) is conducting; when the barred-letter side ($\bar{A}$, $\bar{B}$, $\bar{D}$, or $\bar{C}$) is conducting, the decimal weight is zero. The decimal count can be determined by adding the decimal weighting of the four stages. For example, if the A, $\bar{B}$, D, and C transistors are conducting, where A=1, $\bar{B}$ = 0, D = 4, C = 2, the output is 1 + 0 + 4 + 2 = 7.

b. Binary-coded Decimals. In binary-coded decimal notation, the output is either 1 (when the plain-letter transistor is conducting) or 0 (when the barred-letter transistor is conducting). In binary-coded decimal notation, the order of the binaries is given so that binary-coded decimals can be written with the least significant digit to the right. Thus in the system used in the Model 5245L, the binary-coded decimal notation normally is given in the order DCBA. (Counter binaries are shown in the ABDC order on the schematics and in Figure 4-4C to increase clarity in showing signal flow.) For the decimal count of 7 used as an example in Paragraph a, with D = 1, C = 1, $\bar{B}$ = 0, A = 1, the binary-coded-decimal number would be 1101.

4-27. SEQUENCE. Figure 4-5 shows the counting sequence for a typical decimal counter. Initially each binary is in the "0" (reset) state (decimal count = 0, DCBA = 0000). The following action takes place when a series of input pulses is applied to the counter.

a. The first pulse switches A to the "1" state (DCBA = 0001 = 0 + 0 + 0 + 1 = 1).

b. The second pulse switches A to the "0" state; the output from $\bar{A}$ causes B to switch to the "1" state (DCBA = 0010 = 0 + 0 + 2 + 0 = 2).

c. The third pulse switches A to the "1" state (DCBA = 0011 = 0 + 0 + 2 + 1 = 3).

d. The fourth pulse switches A to the "0" state; the output from $\bar{A}$ switches B to the "0" state; the output from $\bar{B}$ switches both D and C to the "1" state; the resulting signal from C is applied to $\bar{B}$ and D to return B to the "1" state and D to the "0" state (DCBA = 0110). Although $\bar{D}$ is connected to C, no switching occurs at C as a result of the final switching of D since C has not fully recovered from its recent switching.

e. The fifth pulse switches A to the "1" state (DCBA = 0111 = 0 + 2 + 2 + 1 = 5).

f. The sixth pulse switches A to the "0" state; the output from $\bar{A}$ switches B to the "0" state; the output from $\bar{B}$ switches D to the "1" state (DCBA = 1100 = 4 + 2 + 0 + 0 = 6).

g. The seventh pulse switches A to the "1" state (DCBA = 1101 = 4 + 2 + 0 + 1 = 7).

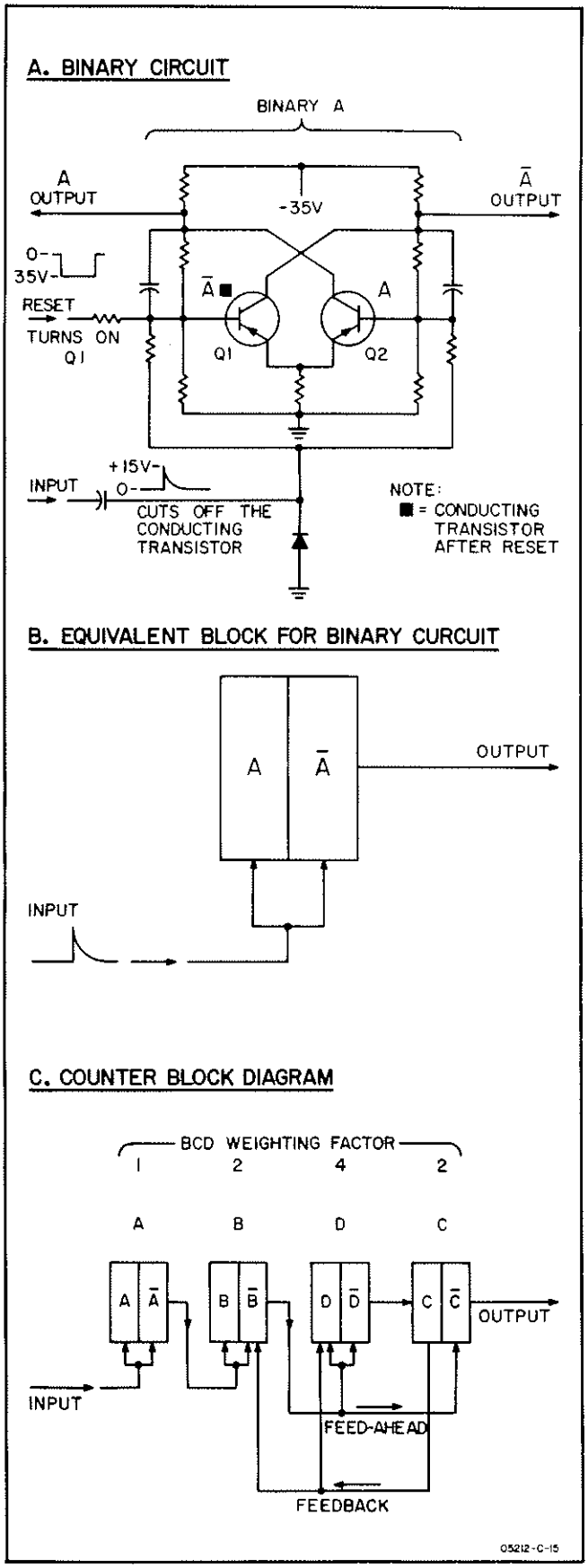


Figure 4-4. Basic Four Binary Counter

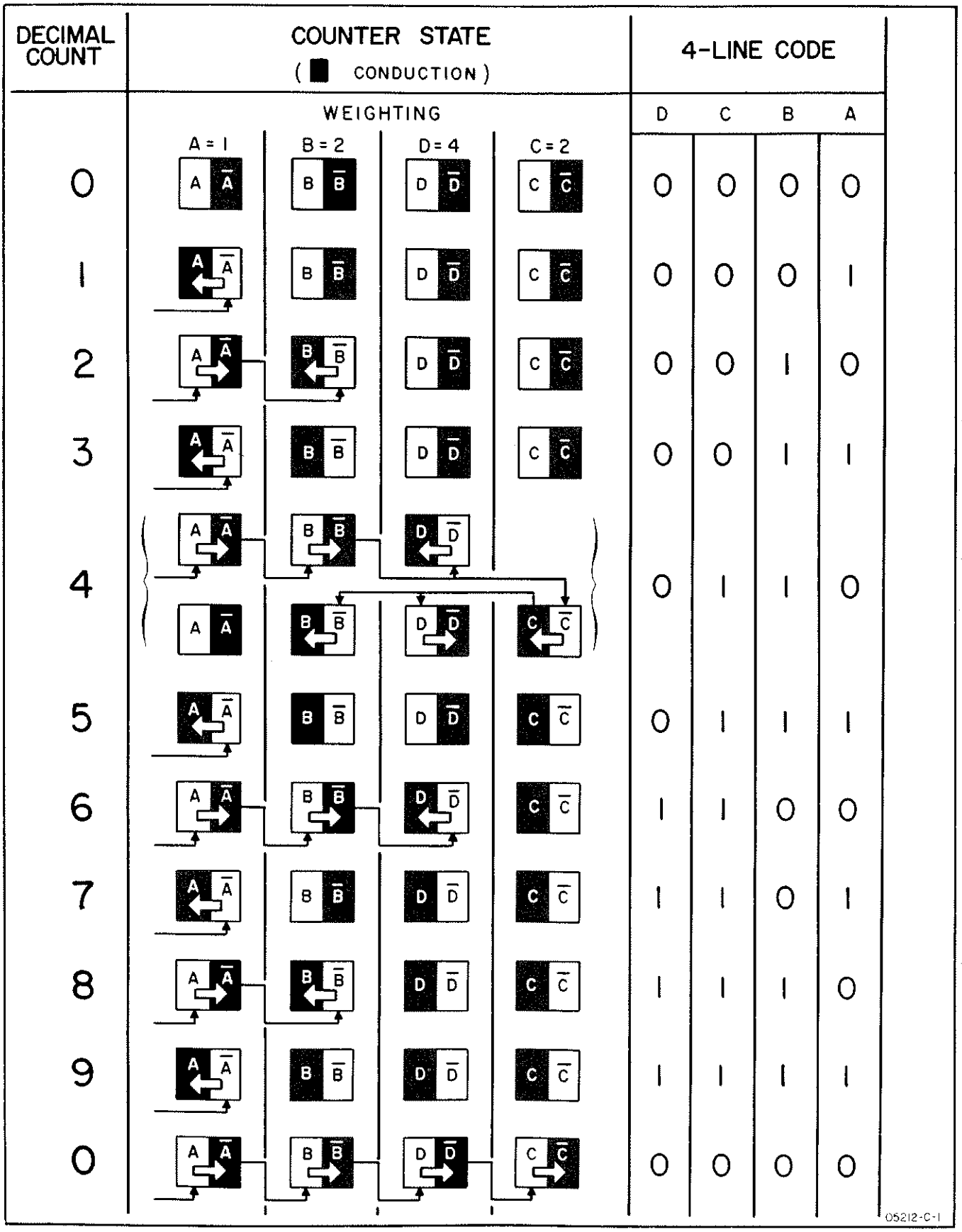


Figure 4-5. Counting Sequence of Four Binary Counter

h. The eighth pulse switches A to the "0" state; the output from $\overline{A}$ switches B to the "1" state (DCBA = 1110 = 4 + 2 + 2 + 2 = 8).

i. The ninth pulse switches A to the "1" state (DCBA = 1111 = 4 + 2 + 2 + 1 = 9).

j. The tenth pulse switches A to the "0" state; the output from $\overline{A}$ switches B to the "0" state; the output from $\overline{B}$ switches D to the "0" state; the output from $\overline{D}$ switches C to the "0" state (DCBA = 0000). When C becomes "0", $\overline{C}$ produces an output pulse which serves as a carry pulse to a following decimal counter assembly. The counter is now returned to its original count.

4-28. RESETTING TO ZERO. The reset pulse, (negative) is applied to the base of the "0" state transistors ($\overline{A}$, $\overline{B}$, $\overline{D}$, $\overline{C}$) in each binary circuit. If the "0" state transistor is conducting, the pulse has no effect; if the "0" state transistor is not conducting, the pulse turns it on. Thus the reset pulse ensures that all four "0" state transistors are conducting. Figure 4-6 indicates a decimal counter assembly receiving a reset pulse. The counter is in the decimal "4" state (DCBA 0110) and the reset pulse returns the decimal counter assembly to the decimal "0" state (DCBA 0000). Decade dividers can be reset as required to any desired state, since reset inputs are available at each transistor. Note the difference between a regular input pulse and a reset pulse: a regular input signal is positive, and causes a conducting transistor to cut off; a reset pulse is negative, and causes a cut-off transistor to conduct.

4-29. Waveforms showing time relationships for the counter are given in Figure 4-7; remember that a driven binary switches only when the input wave is going positive. (Diode clipping removes negative portion of input).

4-30. ELECTRICAL READOUT. A four-line binary-coded-decimal output is available from each decimal counter assembly. A voltage representing the state of each binary is taken from the collector of each of the plain-lettered transistors (A, B, C, and D). A binary "9" is represented by a relatively positive voltage on each line, and a binary "0" is represented by a relatively negative voltage on each line. Table 4-1 summarizes the ten allowable combinations which represent the decimal digits "0" through "9". To protect the binary circuit from being effected by the load, each output line includes a 100K ohm series-connected isolation resistor.

Table 4-1. Four-Line Code Truth Table

Digit	4-Line Code, 0 = negative state, 1 = positive state			
	D	C	B	A
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	1	0
5	0	1	1	1
6	1	1	0	0
7	1	1	0	1
8	1	1	1	0
9	1	1	1	1

4-31. DIGITAL DISPLAY. A display matrix, consisting of eight neon input lamps and 18 photoconductive elements is used to convert the binary-coded representation to a digital representation. The display matrix is shown in Figure 4-8. Figure 4-8A is a diagram of the physical layout of the matrix, and Figure 4-8B indicates the circuit paths to the various digits in the display.

4-32. As indicated in Figure 4-8B, the circuit to each numeral in the display is brought through three series-connected photocell elements. A characteristic of the photocell element is that it is a high resistance element (several megohms) when dark and a relatively low resistance element (less than 7000 ohms) when illuminated. Thus when the three photocell elements which constitute a circuit path are illuminated, resistance drops to about 20,000 ohms and sufficient current can flow to light the display digit. Illuminating elements for the photocells are neon lamps, one of which is connected in the collector circuit of each of the eight transistors in the counting circuit; the lamp lights when the transistor conducts. As explained in Paragraph 4-30, a four-binary counting circuit has ten states, ten combinations of conducting and nonconducting transistors, each combination corresponding to one digit. Thus there is a pattern of lighted lamps for each digit. Assigning a binary weight of 1 when the plain-letter lamp (A, B, C, or D) lights, and a weight of 0 when the bar lamp ($\overline{A}$, $\overline{B}$, $\overline{C}$, or $\overline{D}$) lights, the lamp pattern for any digit can be determined from Table 4-1. Figure 4-8 shows the counting circuit with transistors D, C, $\overline{B}$, $\overline{A}$ conducting. The lamps associated with these circuits illuminate the photocell elements in the circuit to the digit 6 display.

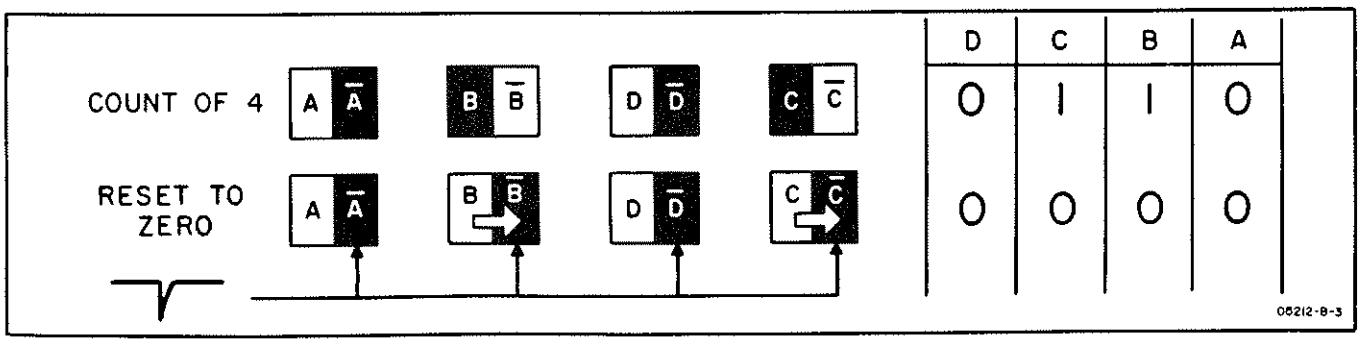


Figure 4-6. Typical Reset Operation in Four-Binary Decimal Counter Assembly

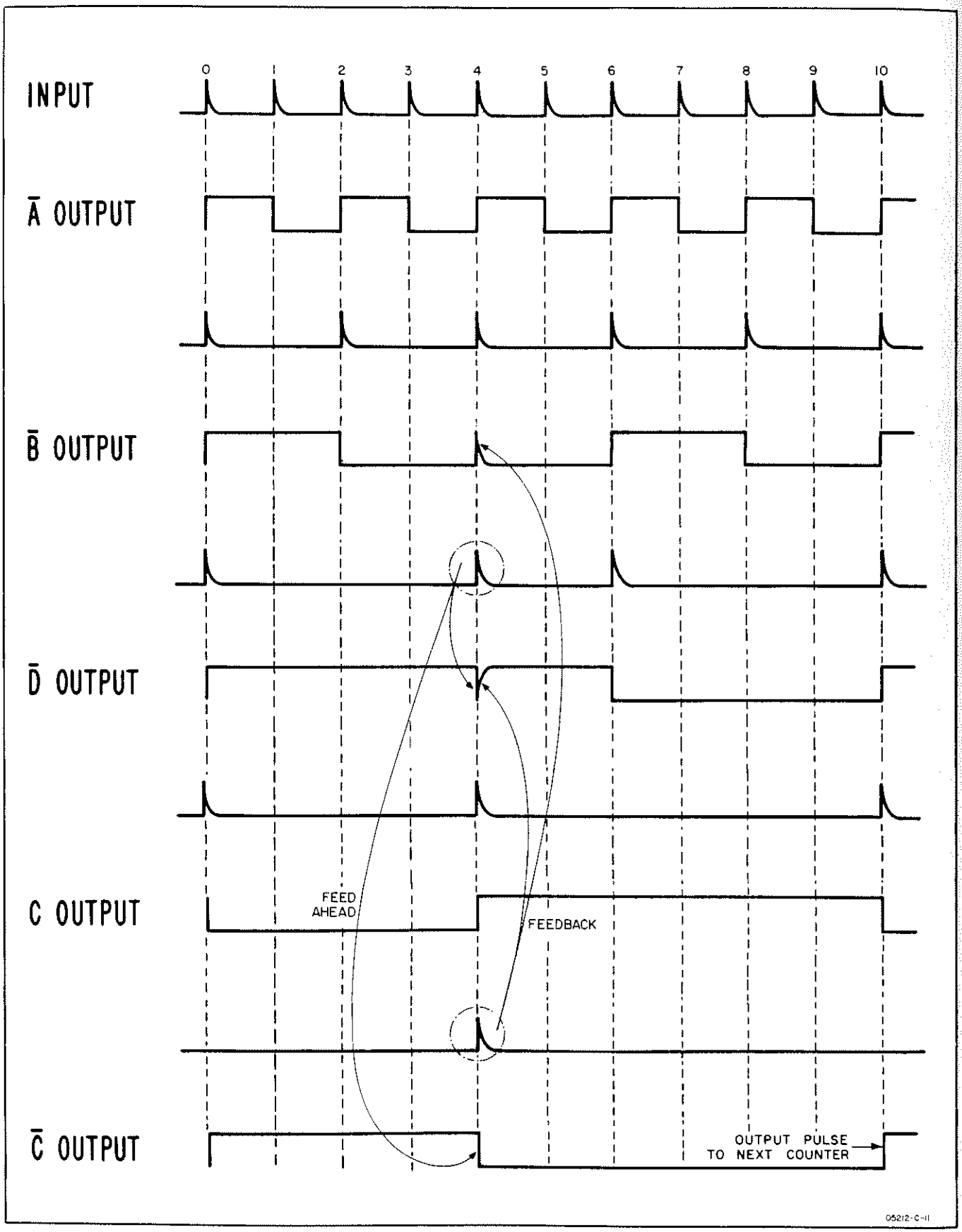


Figure 4-7. Waveforms in Four Binary Counter

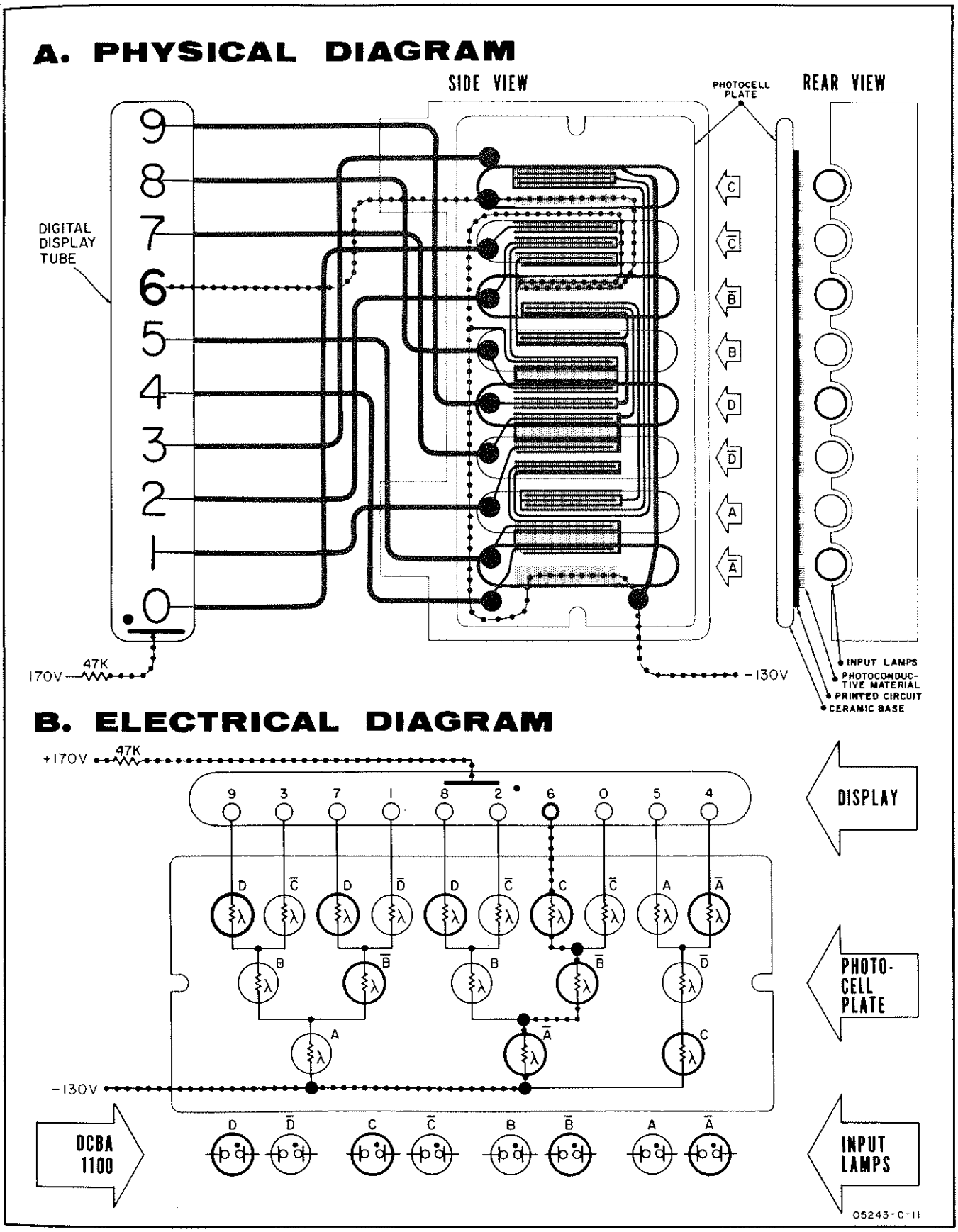


Figure 4-8. Display Matrix

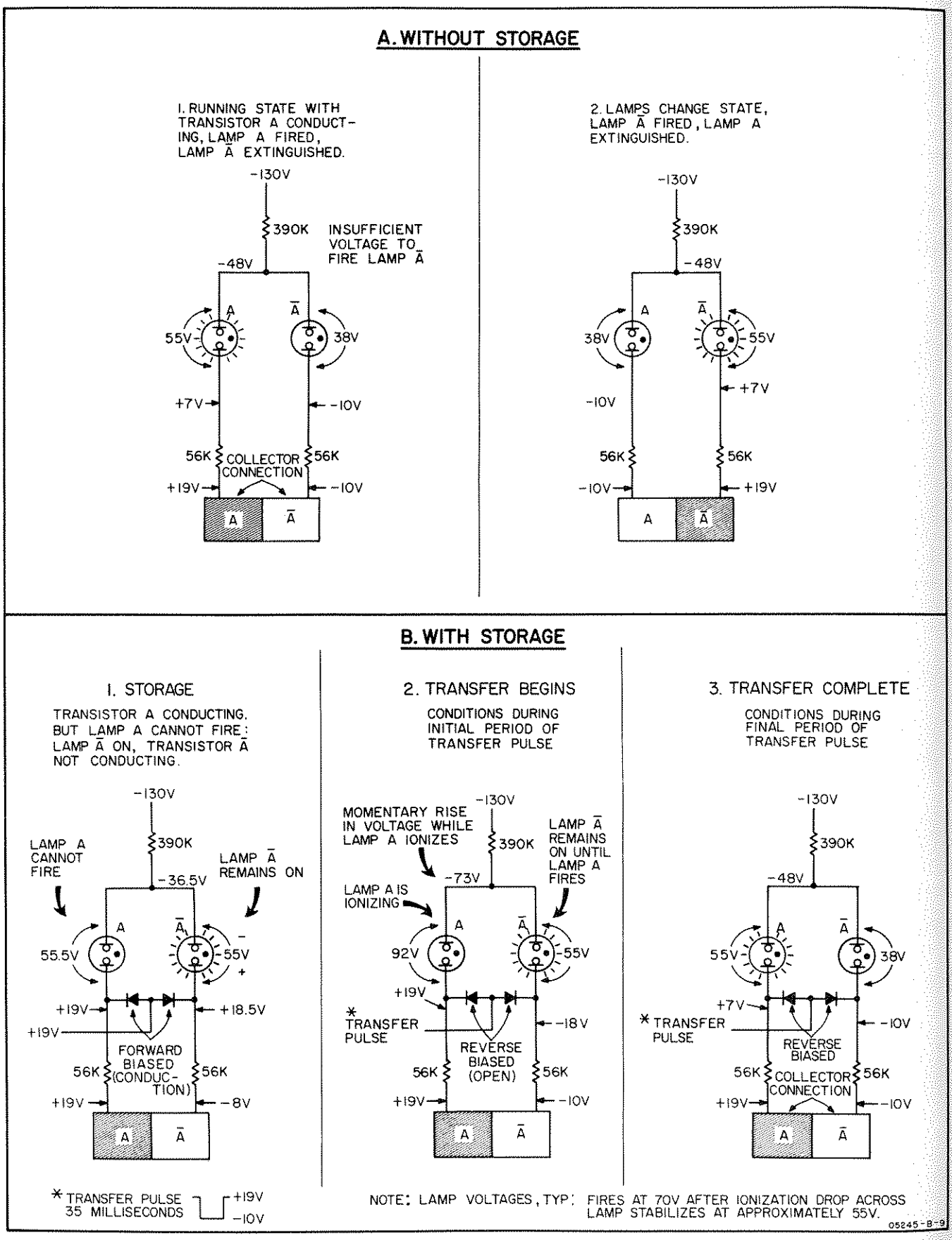


Figure 4-9. Lamp Control

4-33. The circuit sequence required to light a lamp is discussed in the following paragraphs. The sequence discussed will have more meaning if it is remembered 1) that a much higher voltage is required to fire a neon lamp than to maintain illumination in the lamp (for the lamps used in the Model 5245L, 70 volts for firing and 55 volts for maintaining illumination), and 2) that after application of the firing voltage the lamp cannot fire immediately because of the time required for ionization. Arrangement of the binary lamp circuit used in the Model 5245L is indicated in Figure 4-9B. As will be discussed later, diodes connected between the lamps make it possible for the circuit to store a previous count even though the binaries are switching during the next counting period. In decimal counter assemblies which do not have this storage feature, the display changes with each step the binaries take in setting up the circuit for a given digit. To clarify certain aspects of the lamp circuit sequence, the lamp circuit will first be discussed as though there were no diodes between the two lamps of a binary; this circuit is shown in Figure 4-9A.

a. Lamp Circuit without Diodes.

(1) As indicated in Figure 4-9A-1, the lamp associated with the conducting transistor is lighted, the lamp associated with the nonconducting transistor is dark. Typically, voltages will be as shown. Since the transistor associated with the dark lamp is not conducting, no current is flowing in the circuit of the dark lamp, and voltage across it is established (a) by the circuit of the conducting lamp and its transistor, and (b) by the voltage on the collector of the non-conducting transistor. This voltage is not high enough to fire the dark lamp.

(2) When the binary shown in Figure 4-9A changes state, the voltage on the collector of transistor $\overline{A}$ (now conducting) drops to -10 volts, while the voltage on the collector of nonconducting transistor A rises to +19 volts. With transistor A turned off, current through lamp A decreases, and the voltage at the junction of the two lamps rises. Since lamp $\overline{A}$ cannot fire until ionized, voltage will continue to rise until the 70-volt firing level is reached; the junction will reach approximately 73 volts during the ionization period. After the dark lamp fires, the voltage across it stabilizes at about 55 volts, and since the voltage across the other lamp is now reduced to 38 volts, the other lamp extinguishes.

(3) Circuit state after lamp $\overline{A}$ has fired is shown in Figure 4-9A-2; it is the mirror image of that shown in Figure 4-9A-1.

b. Lamp Circuit with Diodes. The steady, or storage, state of the lamp circuit is indicated in Figure 4-9B-1. The diodes are forward-biased, effectively connecting the lamps in parallel and clamping them to approximately -1.5 volts. One lamp is conducting, the other lamp is dark. Since both lamps are clamped to -1.5 volts, regardless of the state of the binary, there will never be sufficient voltage across the dark light to fire it and it will remain dark until 1) the diodes are reverse-biased and 2) there is conduction through the transistor in whose collector circuit the lamp is connected.

(1) When the gate closes at the completion of the counting period (see Paragraph 4-95) a -29 volt transfer pulse (see Paragraph 4-99) is applied to the binary diodes, reverse-biasing them. With the diodes reverse-biased, the lamps are disconnected from each other, and the circuit for each lamp is now completed through its associated transistor.

(2) If the state of the binary is the same as that at the end of the previous counting period, the lamps "see" the voltages required to maintain them without change. If, however, the digit is such that the binary state is changed, the lamps change state. With the diodes reverse-biased, circuit action is the same as that described in subparagraph a. Condition of the circuit during the initial period of the transfer pulse when voltage across the dark lamp is increasing is indicated in Figure 4-9B-2; circuit condition after the lamp has fired is indicated in Figure 4-9B-3.

c. Disabling the Storage. When the function selector is set to MANUAL or the STORAGE switch on the rear panel is in the off position, the storage feature is disabled. Circuit action is then described in subparagraph a.

4-34. BASIC COUNTER FUNCTIONS.

4-35. GENERAL.

a. The basic counter circuits are arranged to provide several functional modes of operation. Each arrangement includes a main AND gate with 1) a signal input and 2) a control input, or gating signal. Following the main gate is a cascaded series of decimal counters which accumulate and display the total number of pulses which pass through the main gate. The various modes of operation are discussed in Paragraphs 4-36 through 4-41.

b. Circuit sequence in the various modes of operation is similar: pulses pass through the main gate to the decimal counters for a predetermined time, are counted and displayed. The difference between arrangements is in 1) the source of the pulses counted, and 2) the source of the gating signal which establishes the length of time during which the main gate is open to pass pulses to the decimal counters.

4-36. TOTALIZING. In the totalizing mode (see Figure 4-10A), the gate flip-flop is controlled by the FUNCTION switch when it is in the MANUAL START or MANUAL STOP positions. The decimal counters count the total number of input pulses applied while the main gate is held open with the FUNCTION switch in the MANUAL START position. Switching the FUNCTION switch to the MANUAL STOP position closes the main gate and the number of pulses which came through the main gate while it was open are displayed.

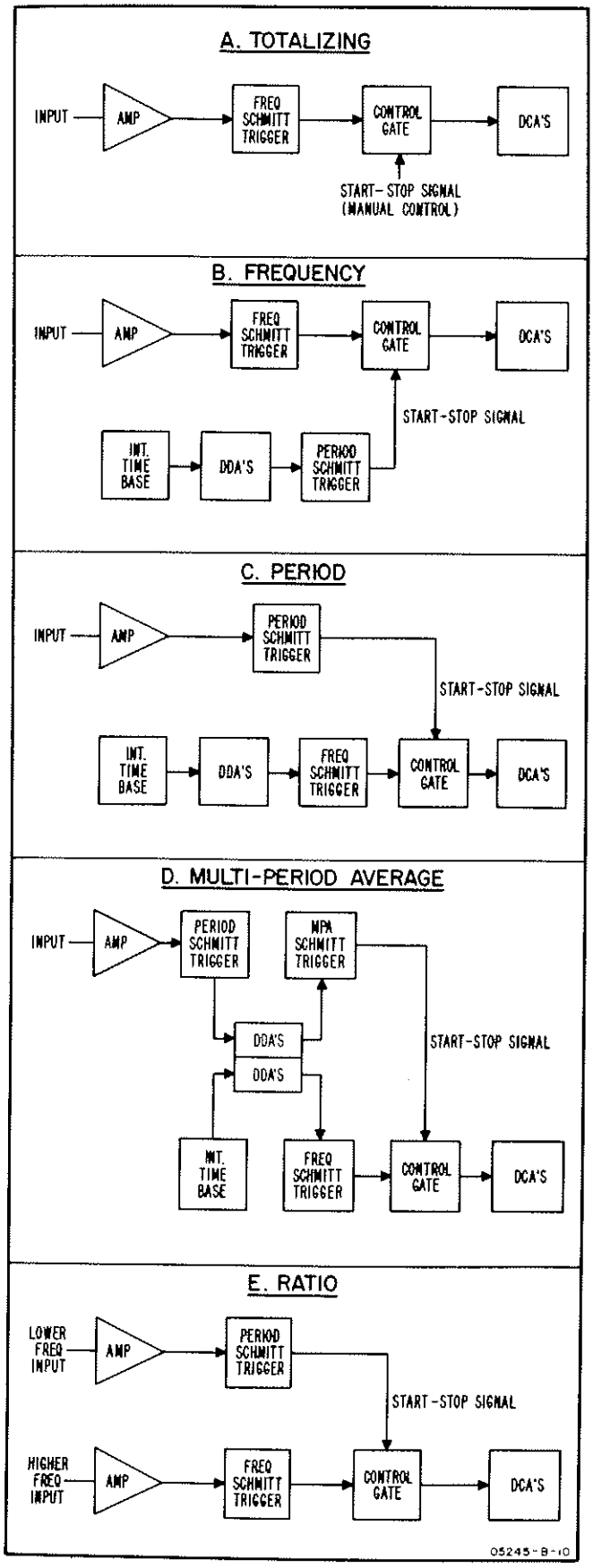


Figure 4-10. Basic Counter Functions

4-37. FREQUENCY MEASUREMENT. The circuit arrangement shown in Figure 4-10B permits control of the main gate by the counter time base. The gate is opened for a controlled time, therefore the accumulated count represents the number of input cycles or pulses during this time. Controlled intervals are from 10 seconds down to 1 microsecond in decade submultiples, selectable with the front panel TIME BASE switch. The decimal point is automatically positioned and the readout is in kilocycles or megacycles with the units in line with the digital display.

4-38. PERIOD MEASUREMENT. The arrangement shown in Figure 4-10C provides the means for measuring the period of the input signal. The period of a signal is the time required for the completion of one cycle; the counter displays the time in seconds, milliseconds or microseconds. The period measurement is obtained by making the duration of the gating signal equal to the period of the input signal, and counting a train of pulses supplied by the counter time base. The displayed count is the number of time-base pulses which occur during one period of the input signal. For multiple period measurements, Figure 4-10D, the input signal is divided by the selected decade factor so that the gating signal is the selected multiple of one period. The decimal point is positioned to give the readout in seconds, milliseconds or microseconds for a single period of the input signal.

4-39. RATIO MEASUREMENT. As shown in Figure 4-10E, the frequency ratio of two inputs can be measured by a circuit arrangement similar to that used for period measurement. One input signal is applied to the main gate while the gating signal is made equal to the period (or decade multiple of the period) of the other signal. The displayed count represents the number of cycles of one input which occur during the period of one cycle (or decade multiple of one cycle) of the other input.

4-40. STANDARD FREQUENCY OUTPUTS. Multiplier and decade divider circuits connected to the internal 1 Mc oscillator provide output frequencies from 10 Mc to 0.1 cps (in decade steps) using the arrangement shown in Figure 4-11.

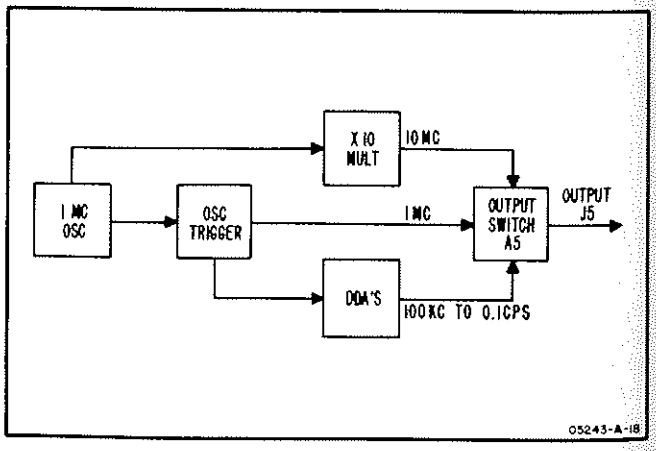


Figure 4-11. Standard Frequency Outputs

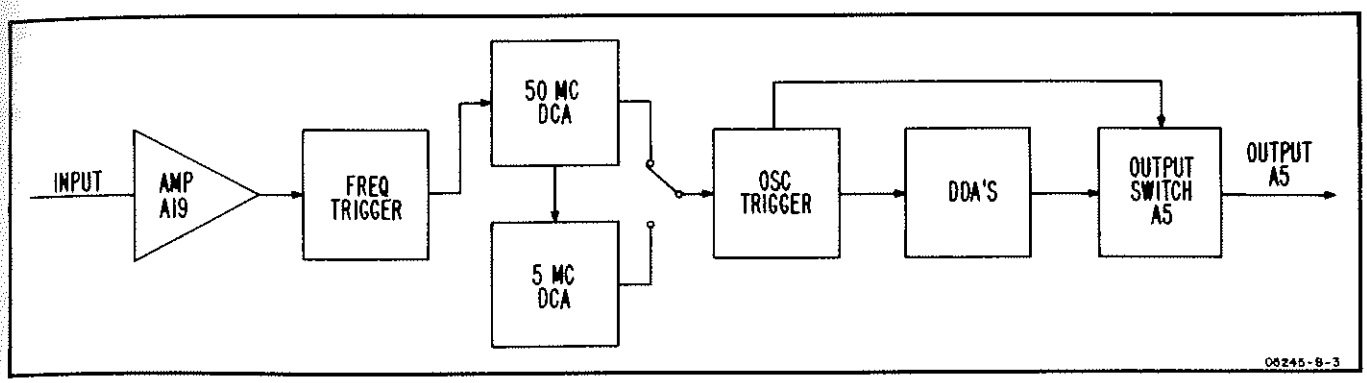


Figure 4-12. Scaler Operation

4-41. SCALER OPERATION. An input can be scaled by a factor from 10 to 10^9 (in decade steps) using the arrangement shown in Figure 4-12. Note that the first two divisions are done by the high-speed decimal counters which in this case function as decade dividers.

4-42. TIME SEQUENCE.

4-43. GENERAL. Following a counter measurement there are several operations which occur in a particular sequence. The pulses which control these operations and their time relation to each other are shown in Figure 4-13. The trailing edge of the gating pulse (end of count) triggers the one-shot multivibrators (Paragraph 4-19) which generate these pulses.

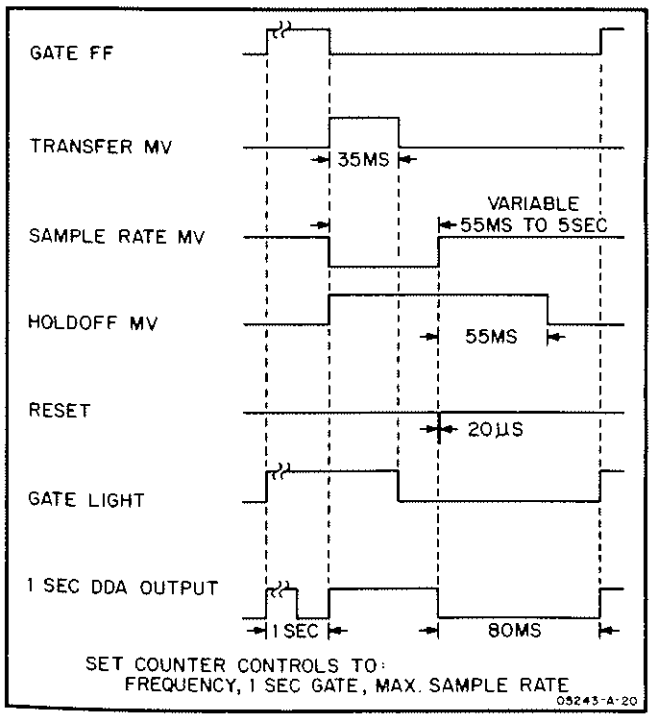


Figure 4-13. Time Sequence

4-44. TRANSFER. The transfer multivibrator is triggered at the end of the gating signal, and it produces a 35-millisecond pulse. The transfer pulse is applied to the decimal counters to transfer the new count to the display. During a measurement function the count is stored in the storage binaries until the transfer pulse allows the new count to be displayed.

4-45. SAMPLE RATE. The sample-rate multivibrator is triggered at the leading edge of the transfer pulse; it produces a pulse which may be varied from 55 milliseconds to 5 seconds with the front panel SAMPLE RATE control. The trailing edge of the sample rate pulse is differentiated to operate the reset amplifier. The reset pulse resets the decimal counters and low-frequency decade dividers.

4-46. HOLDOFF. The holdoff multivibrator produces an output pulse which starts at the leading edge of the sample rate pulse and lasts until 55 milliseconds after the end of the sample-rate pulse. The holdoff pulse disables the gate flip-flop to prevent retriggering until the sample rate multivibrator timing capacitor has completed recharging. A sync pulse from the gate control circuit (collector of Q1 through C10 or when in TIME INTERVAL from the start line through CR7 and C11) gives the holdoff pulse a precise length and prevents the gate flip-flop from being triggered prematurely. During the slight delay between the end of the gating pulse and the start of the holdoff pulse, the gate flip-flop is disabled by an inhibit signal from the transfer multivibrator.

4-47. OVERALL COUNTER OPERATION.

4-48. The entire counter is shown in a logic block diagram in Figure 4-14. The front-panel FUNCTION switch applies a control voltage to selected AND gates in the function control assembly (A21) to arrange circuits for each counter function (see tabulation in Figure 5-5). The front-panel TIME BASE switch arranges the decade dividers (A28-A34) into two groups using gate circuits in the time-base control assembly (A35); the first group produces decade division of the oscillator (A26) output, and the second group produces decade division of the counter input during multiplied period measurements. For details of inter-connections between circuit modules (assemblies) refer to the overall diagram Figure 5-5.

4-49. INPUT SWITCH ASSEMBLY A1.

4-50. The input switch assembly, designated SENSITIVITY (VOLTS RMS) on front panel, is a five-position switch (CHECK, 10, 1, .1, and PLUG-IN). Refer to the schematic diagram, Figure 5-7, for circuit details. Switch functions are listed below.

a. Provides three attenuation steps (X1, X10, X100) for signal applied to the SIGNAL INPUT connector. The attenuator output is connected to the input amplifier A19.

b. Connects output of plug-in unit to input amplifier A19 when switched to PLUG-IN position.

c. Produces gate controls 1, 2, 3, 5, 6, and 27 by combining switched -15 volts from A3 (FUNCTION switch); distinguishes between CHECK and not-CHECK positions.

d. Combines switched -15 volts from A3 to contribute to generation of gate controls 4, 21, 22, 23, 24, 25, 26, 27, 28, and 29; distinguishes between CHECK and not-CHECK positions. Switching for these gate controls is finished in A2 (TIME BASE switch).

e. Switches +170 volts as first step in generating lamp control voltages (distinguishes between CHECK and not-CHECK positions). Further switching is done by A3, final switching by A2.

4-51. TIME-BASE SWITCH ASSEMBLY A2.

4-52. The time-base switch assembly (designated TIME-BASE on front panel) is a 10-position switch (EXT, 10s, 1s, .1s, 10ms, 1ms, .1ms, 10μs, 1μs, .1μs). Refer to the schematic diagram, Figure 5-9, for circuit details. Switch functions are listed below.

a. Produces gate controls 4, 21, 22, 23, 24, 25, 26, 27, 28, and 29 using switched -15 volts from A1 (SENSITIVITY switch).

b. Produces all decimal point control voltages using switched +170 volts from A3 (FUNCTION switch). Decimal point control voltages are connected to appropriate input terminals on decimal point assembly A8.

c. Produces all measurement units control voltages using switched +170 volts from A3. Measurement unit control voltages are connected to appropriate input terminals on measurement units assembly A9.

d. Generates reset pulses by momentarily supplying -15 volts while switch is between detent positions. This resets all counter circuits if time-base selection is changed during a measurement operation. Reset output is connected to manual reset input of sampling control assembly (pin 9 of A23).

e. Connects time-base selected frequency from A21 (function control assembly) to EXT connector on front panel when switch is not in EXT position. Disconnects selected frequency from EXT connector when switch is in EXT position.

4-53. FUNCTION SWITCH ASSEMBLY A3.

4-54. The function switch assembly (designated FUNCTION on the front panel) is a 10-position switch (MANUAL STOP; MANUAL START; FREQUENCY; PERIOD AVERAGE for 1, 10, 100, 1K, 10K, and 100K periods; and REMOTE OR TIME INT). Refer to the schematic diagram, Figure 5-11, for circuit details. Switch functions are listed below.

a. Produces gate controls 7 through 13 by switching -15 volts from power supply.

b. Contributes to generation of gate controls 1 thru 6 and 21 thru 29.

c. Contributes to generation of decimal point and measurement units controls from switched +170 volts from A1 (SENSITIVITY switch).

d. Produces start and stop input voltages (-15 volts) to gate flip-flop in the gate control assembly (pins 13 and 14 of A23) when switched to MANUAL START and MANUAL STOP.

e. Shorts sample-rate trigger pulse to ground at pin 4 of A23 when switched to either MANUAL START or MANUAL STOP. This inhibits operation of the sample rate and holdoff multivibrators, thereby preventing the reset amplifier from operating in MANUAL functions. This arrangement allows the accumulation of counts in the DCA's over several gate openings during MANUAL operation. Reset is still possible in the MANUAL function by use of the RESET push button on the front panel.

f. Opens the transfer-pulse line between the STORAGE switch on the rear panel and the decimal counters when switched to either MANUAL START or MANUAL STOP. This prevents display storage operation.

g. Opens inhibit-signal line between the DIGITAL RECORDER connector on the rear panel and pin 12 of A23 when switched to either MANUAL START or MANUAL STOP. This prevents undesired triggering of the holdoff multivibrator which could inhibit the gate flip-flop.

h. Generates reset pulses by momentarily supplying -15 volts while switch is between detent positions. This resets all counter circuits if function selection is changed during a measurement operation. Reset output is connected to manual reset input of sampling control assembly (pin 9 of A23).

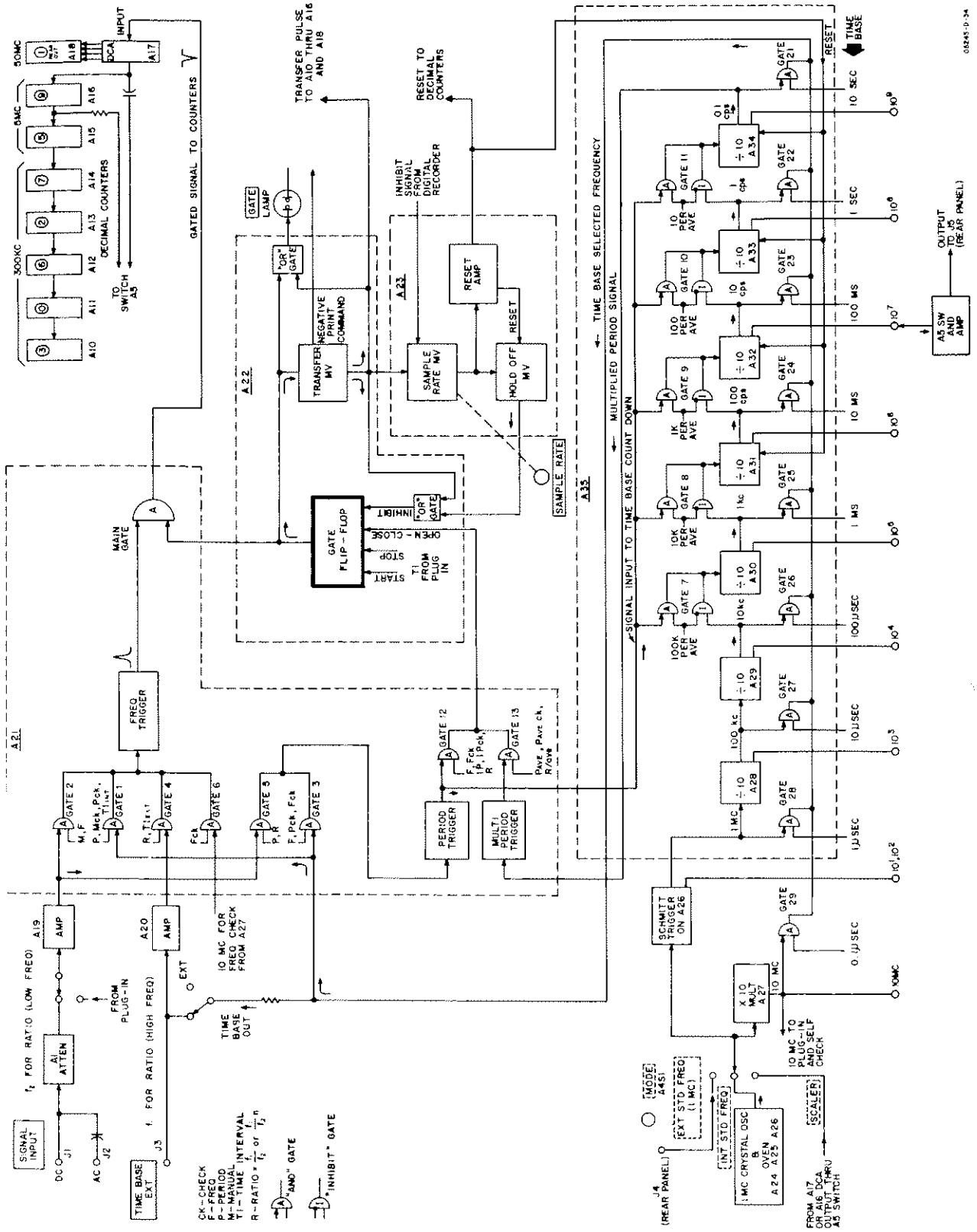


Figure 4-14. Model 5245L Logic Block Diagram

4-55. MODE SWITCH ASSEMBLY A4.

4-56. The mode switch assembly (designated MODE on rear panel) is a three-position switch (EXT STD FREQ 1 MC, INT STD FREQ, SCALER). Refer to the schematic diagram, Figure 5-13, for circuit details. Switch functions are listed below:

a. Connects external 1-Mc standard to trigger-circuit of the oscillator assembly (A26) when in EXT STD FREQ 1 MC position.

b. Connects output of internal oscillator to trigger-circuit of oscillator assembly when in INT STD FREQ position.

c. With A5, connects output of first or second decimal counter (A16 or A17) to trigger-circuit of oscillator assembly when in SCALER position.

d. Provides AC ground through bypass capacitor for signals not selected as input for trigger-circuit of oscillator assembly.

4-57. OUTPUT SWITCH ASSEMBLY A5.

4-58. The output switch assembly (designated OUTPUT on rear panel) includes an amplifier stage and a nine-position switch (.1~ through 10 Mc and 10^9 thru 10 in decade steps). Circuit details are shown in the schematic diagram, Figure 5-13. Switch functions are listed below:

a. Provides standard frequency signals at OUTPUT connector from counter time base if MODE switch is not set to SCALER position. Normally provides all frequencies from .1 cps to 10 Mc in decade steps but frequencies of 100 cps and below are interrupted when counter is reset, and availability of frequencies of 1 kc and below depends on setting of FUNCTION switch.

b. Provides scaling of input signals by factor of 10 to 10^9 (in decade steps) at the OUTPUT connector when MODE switch is set to SCALER and FUNCTION switch is set to MANUAL START.

c. Amplifies selected output for all selections (except standard frequencies of 1 Mc and 10 Mc and scaler ratio of 10 and 100; amplifier is disabled by +13 volt bias supplied when these outputs are selected).

4-59. POWER SUPPLY: RECTIFIER ASSEMBLY A6; REGULATOR ASSEMBLY A7.

4-60. GENERAL. Several supplies are included in the 5245L. Their characteristics are tabulated in Table 4-2.

Table 4-2. Power Supplies

Supply	Regulated	Remarks
-15 v	Yes	Series reg
+13 v	Yes	Series reg
+20 v	Yes	Series reg
-130 v	No	-150 v ref to +20 v
+170 v	No	+150 v ref to +20 v

Note

In the following discussion complete reference designations are used to identify components. This is to prevent confusion between reference designations of power-supply components located on the chassis and components located on the rectifier assembly (A6) and regulator assembly (A7). For example, "R1" would refer to a component located on the chassis, while "A7R1" would refer to a component located on the regulator assembly. Complete designations are used when confusion might exist between chassis components and circuit-board components.

4-61. PRIMARY POWER. As shown in Figure 5-15 either 115- or 230-volt AC power is connected through an LC filter (C5A, C5B, L1, L2), fuse F1 and front-panel power switch S3B (part of SAMPLE RATE control) to the primary of power transformer T1 and T2. Moving slide switch S4 on the rear panel to the left exposes "115" and connects the primaries in parallel for 115-volt operation. Moving the slide switch to the right exposes "230" and connects the primaries in series for 230-volt operation. Transformer T1 supplies power for continuous operation of the crystal-oven-heater control circuits; note that turning off the counter does not turn off the power to the crystal oven. Fan motor B1 is connected across a single primary winding; T2 functions as an autotransformer to supply 115-volts to B1 when the instrument is connected for 230-volt operation.

4-62. MINUS 15-VOLT SUPPLY. The regulated -15 volt supply consists of a full-wave rectifier (A6CR1 through A6CR4) whose output is smoothed by filter L3-C6, regulated by Q2, and further filtered by A7C2. The A7R4, A7R5, A7R6 divider supplies a sample of the regulated output to A7Q2 which amplifies and inverts variations in the sample. The A7Q2 output controls driver A7Q1 which in turn controls regulator Q2. Potentiometer A7R5 permits adjustment of the regulated output voltage by providing a means of adjusting A7Q2 bias.

4-63. REGULATOR OPERATION. Operation may be traced as follows: Suppose the output voltage tends to shift toward -14 volts. This causes the voltage at the A7Q2 base to go in a positive direction resulting in a decrease of conduction and a negative swing in A7Q2 collector voltage; driver A7Q1 increases conduction (A7Q1 emitter and Q2 base voltage go negative); regulator Q2 increases conduction and returns the output voltage to -15 volts.

4-64. OTHER REGULATOR COMPONENTS. Breakdown diode A7CR1 provides a 6.8-volt reference to the emitter of A7Q2. The A7R1-A7C1 network provides phase correction for stability during transients.

4-65. -130 VOLT AND +170 VOLT SUPPLIES. Two conventional full-wave rectifiers supply unregulated +170 volts and -130 volts. Each rectifier circuit provides a 150-volt output (filtered by C7 and C8), but the circuits are referenced to +20 volts so the actual output voltages (relative to ground) are +170 volts and -130 volts. Note that the -130 volt supply is the source for shunt regulator A7CR2 which provides -56 volts to the -15 volt regulator circuit.

4-66. +13-VOLT AND +20-VOLT SUPPLIES. The +13-volt supply (Q3, A7Q3, and A7Q4; see schematic Figure 5-15) is similar to the -15 volt supply described in Paragraph 4-62. The only significant difference is that the negative leg is grounded while the positive leg provides the regulated output. The +20 volt supply is obtained by adding a 7 volt source to the +13 volt supply. The 7 volt regulator consists of Q4 and A7Q5, both acting as emitter followers. A 7 volt zener diode and a bias adjustment circuit provide the reference voltage for this supply.

4-67. DECIMAL POINT ASSEMBLY A8.

4-68. INPUT. The decimal point assembly holds eight neon lamps which are located to the left of each digital display tube on the front panel. Lamps are designated 0 through 7 from right to left as seen looking at the front panel. The decimal point control signal consists of +170 volts applied to the desired lamp input. Control is supplied either from the TIME BASE switch or the lower REMOTE CONTROL connector on the rear panel.

4-69. OUTPUT. A group of OR gates converts the decimal point control signal from decimal form to binary-coded decimal (BCD) form which is supplied to the DIGITAL RECORDER connector on the rear panel. As an example, suppose decimal point 5 is lighted; a positive signal passes the OR gates and limiters to the A, B, and C output lines, thus providing a 0111 (in the order DCBA) output to the DIGITAL RECORDER connector. For circuit details refer to the schematic diagram, Figure 5-17.

4-70. MEASUREMENT UNITS ASSEMBLY A9.

4-71. INPUT. The measurement units assembly holds six neon lamps which are located on the front panel at the right end of the counter display. Lamps are designated MC, KC, SEC, mS, μS, and *(asterisk). As with the decimal point assembly, the measurement units control signal consists of +170 volts applied to the desired lamp input. Control is supplied either from the TIME-BASE switch or the lower REMOTE CONTROL connector on the rear panel.

4-72. OUTPUT. A group of OR gates converts the measurement units control signal from decimal form to BCD form, just as is done in the decimal point assembly. The digit which is printed for each measurement unit is given in a table along with the schematic diagram, Figure 5-17. Print wheels are available for Hewlett-Packard recorders so that the correct measurement units symbol can be printed directly.

4-73. LOW FREQUENCY DECIMAL COUNTER ASSEMBLY A10-A14.

4-74. The low-frequency decimal counter is shown in Figure 4-15A. Note the inclusion of clipper diodes CR9 through CR13 which permit only positive pulses to be delivered to the input base of each transistor. Operation of basic circuits is discussed in the Paragraphs listed in Table 4-3. Circuit details are given in the schematic diagram, Figure 5-19.

Table 4-3. Basic Operation Summary of Four-Binary Counter

Area	Paragraph Reference
Binary circuits and counting logic	4-15 through 4-17
Resetting	4-28
Electrical readout	4-30
Digital display	4-31 through 4-33
Decimal point	4-67
Clipper diodes	4-8

4-75. 5-MC DECIMAL COUNTER ASSEMBLY A15, A16.

4-76. GENERAL. The 5-Mc decimal counter operates in a manner similar to the low frequency counter. The circuits have been modified to speed up binary switching. Operation of basic circuits is discussed in the paragraphs listed in Table 4-3. Circuit details are given in the schematic diagram, Figure 5-21.

4-77. STEERING DIODES. Input leads to each transistor include series-connected steering diodes CR9 through CR20 which act as AND gates to permit applications of the input pulse to the conducting transistor only. For example, if binary A is in the "1" state (Q1 cut off, Q2 conducting), CR11 is forward biased as a result of the relatively negative voltage existing at the junction of the A input (Q2 base) and the CR11 cathode; CR11 therefore passes the positive driving pulse to the A input. At the same time CR9 is reverse biased as a result of the relatively positive voltage existing at the junction of the $\bar{A}$ (Q1 base) and the CR9 cathode; CR9 therefore does not permit the positive input pulse to be applied to $\bar{A}$ input.

4-78. HIGH-FREQUENCY FEATURES. Features which contribute to high-speed operation, contrasting circuits in the 5-Mc decimal counter with that of the lower-frequency counter described in Paragraph 4-73, include the use of a) steering diodes (discussed above), b) high-frequency transistor types, and c) reduced time constants (smaller R, smaller C) in the interstage coupling networks.

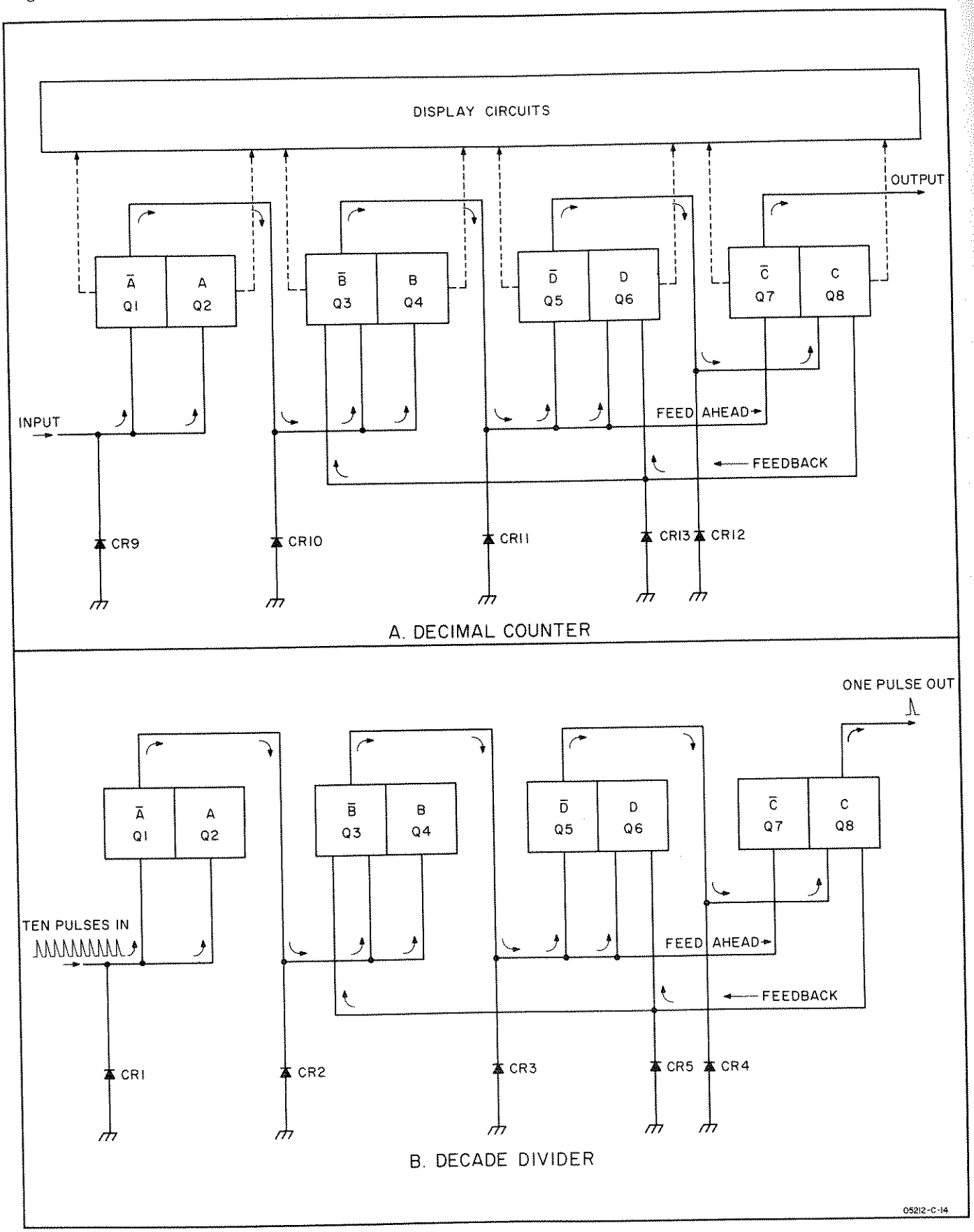


Figure 4-15. Decimal Counter and Decade Divider Block Diagram

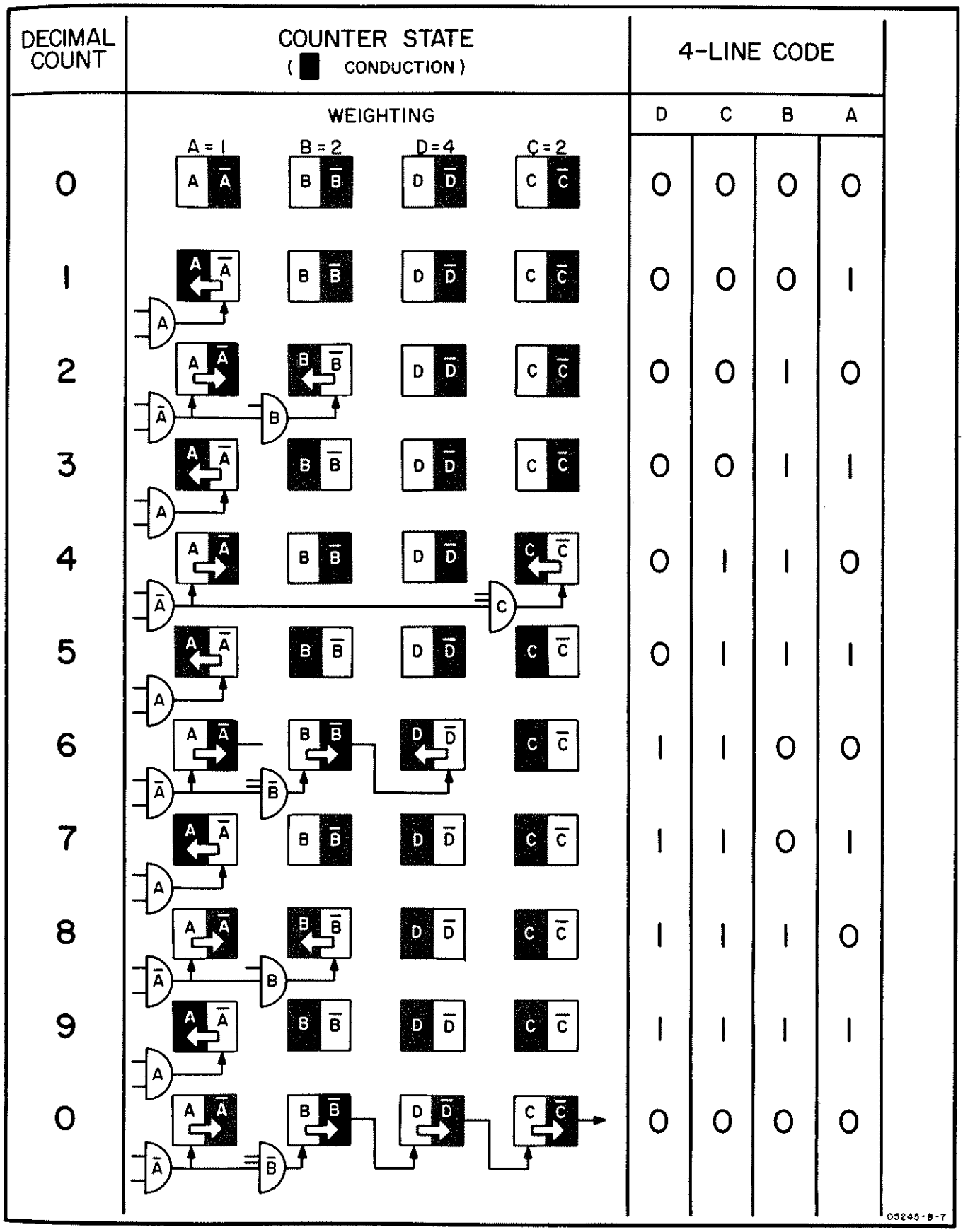


Figure 4-16. 50 Mc Counting Sequence

4-79. 50-MC DECIMAL COUNTER ASSEMBLY A17.

4-80. GENERAL. The 50-Mc decimal counter assembly is shown in Figure 4-17. Operation of basic circuits is discussed in the Paragraphs listed in Table 4-3. Circuit details are given in the schematic diagram, Figure 5-23.

4-81. GATED INPUT. Five AND gates route the input signal to the proper transistor base for each count: feedback is not used. Each of these gates is labeled to indicate the results of an input pulse passed by that gate For example, the first input pulse is passed by gate A (diode gate A is forward biased by the negative collector voltage of transistor $\bar{A}$). This negative pulse turns off transistor $\bar{A}$ which turns on transistor A. In the same way gate $\bar{A}$ passes the second pulse turning on transistor $\bar{A}$. On counts 2, 4, 6, 8, and 0 (10) the input pulse passed by gate $\bar{A}$ is amplified and applied to the inputs of gates B, $\bar{B}$, and C. Gate B conducts when both an input pulse is present and transistor B is not conducting (this occurs on counts 2 and 8). Gate $\bar{B}$ conducts when both an input pulse is present and transistors $\bar{B}$ and $\bar{C}$ are both turned off (this occurs on counts 6 and 0). Gate C conducts when an input pulse is present and transistors $\bar{B}$ and C are both turned off (count 4).

4-82. OUTPUT. The common emitter amplifier inverts the output and provides the voltage gain necessary to drive the 5-Mc counter assembly.

4-83. 50-MC READOUT ASSEMBLY A18.

4-84. GENERAL. The 50-Mc readout assembly (A18) receives the binary-coded decimal output from the 50-Mc decimal counter A17; it provides both front-panel digital display and amplified binary-coded-decimal signals. Circuit details are shown in the schematic diagram, Figure 5-25.

4-85. AMPLIFIERS. Transistors Q1 through Q8 are arranged in four pairs (amplifiers A, B, D, and C). Each amplifier pair controls a pair of neon lamps in the display matrix (for detailed discussion of digital display see Paragraphs 4-31 through 4-33.

4-86. AMPLIFIER OPERATION. As an example of amplifier operation, suppose that the A input became relatively negative, equivalent to binary "0", conduction through Q1 would decrease, resulting in a relatively negative voltage at the Q1 emitter and a relatively positive voltage at the Q1 collector, thus permitting the $\bar{A}$ neon lamp to light; the output of Q1, coupled to Q2 by way of emitter resistor R22 and voltage divider R20-R21, results in conduction of Q2, the Q2 collector voltage therefore becomes relatively negative, representing binary "0", and is supplied as the A output. Operation is reversed upon receipt of a relatively positive input (binary "1") and results in lighting of the A neon lamp and supplying a relatively positive A output, representing binary "1". The B amplifier (Q3-Q4), the D amplifier (Q5-Q6), and the C amplifier (Q7-Q8) operate in a similar manner.

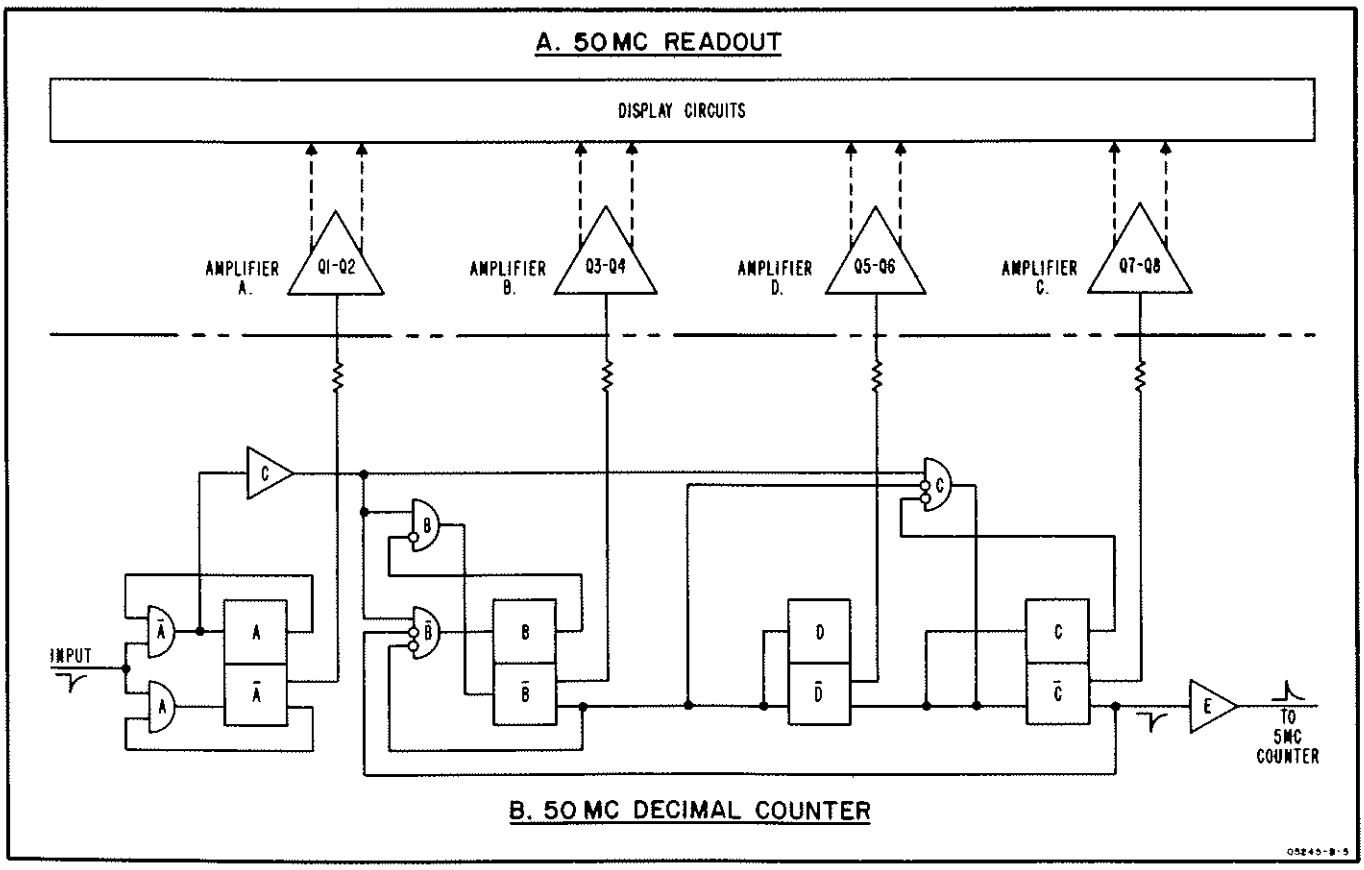


Figure 4-17. 50-Mc Readout and 50-Mc Counter Block Diagram

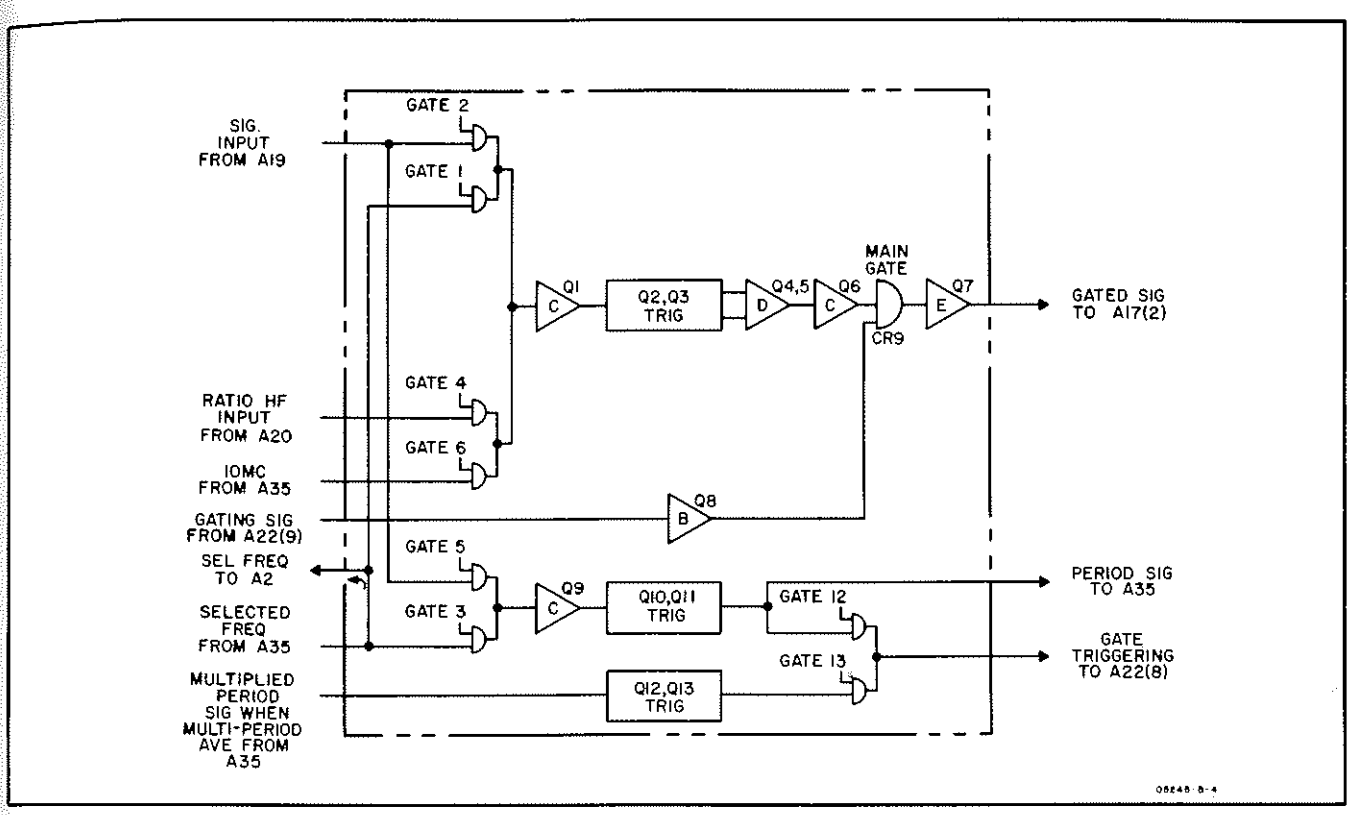


Figure 4-18. Function Control Block Diagram

4-87. INPUT AMPLIFIER ASSEMBLY A19-A20.

4-88. The input amplifiers provide stable voltage gain for signals applied to the SIGNAL INPUT or TIME BASE EXT connectors on the front panel. Diodes CR1 and CR2 are diode limiters (Paragraph 4-8). The DC voltage at the input can be adjusted to zero using potentiometer R4. Potentiometer R7 permits adjustment of the DC level of the amplifier output to provide the proper input level for following trigger circuits. For circuit details, refer to the schematic diagram, Figure 5-27.

4-89. FUNCTION CONTROL ASSEMBLY A21.

4-90. GENERAL. The function control assembly, Figure 4-18, performs the key switching operations to arrange counter circuits for different measurements. The signal which is counted by the decimal counters is always supplied through the main gate (CR9); this means that at all times one of the gates 1, 2, 4, or 6 must be on. The triggering pulse which is supplied to the gate flip-flop is always supplied by the output of either gate 12 or gate 13, and if gate 12 is on then either gate 3 or gate 5 must be on.

4-91. SIGNAL FLOW. The following outline gives signal flow for each measurement function. In each case the control signal to the main gate is on during counting.

a. MANUAL. Input signal from A19 passes through gate 2, Q1, trigger Q2-Q3, Q4-Q5, Q6, main gate, and Q7 to gated signal output.

b. MANUAL CHECK. Same as MANUAL except gate 2 is off and gate 1 is on so that the selected frequency from decade dividers passes through to gated signal output.

c. FREQUENCY. Input signal path same as for MANUAL. Selected frequency passes through gate 3, Q9, trigger Q10-Q11, and gate 12 to the gate triggering output.

d. FREQUENCY CHECK. Same as for FREQUENCY except gate 2 is off and gate 6 is on so that a 10-Mc signal passes to gated signal output.

e. PERIOD. Selected frequency from first group of decade dividers passes through gate 1, Q1, trigger Q2-Q3, Q4-Q5, Q6, main gate, and Q7 to the gated signal output. Input signal passes through gate 5, Q9, trigger Q10-Q11, and gate 12 to the gate triggering output.

f. PERIOD CHECK. Same as PERIOD except that gate 5 is off and gate 3 is on so that the selected frequency (always 100 kc for PERIOD CHECK) from the first group of decade dividers passes to the gate triggering output.

g. MULTI-PERIOD. Same as PERIOD except that gate 12 is off and gate 13 is on. The output of trigger Q10-Q11 becomes the input to the second group of decade dividers; the output of these dividers drives trigger Q12-Q13 and passes through gate 13 to the triggering output.

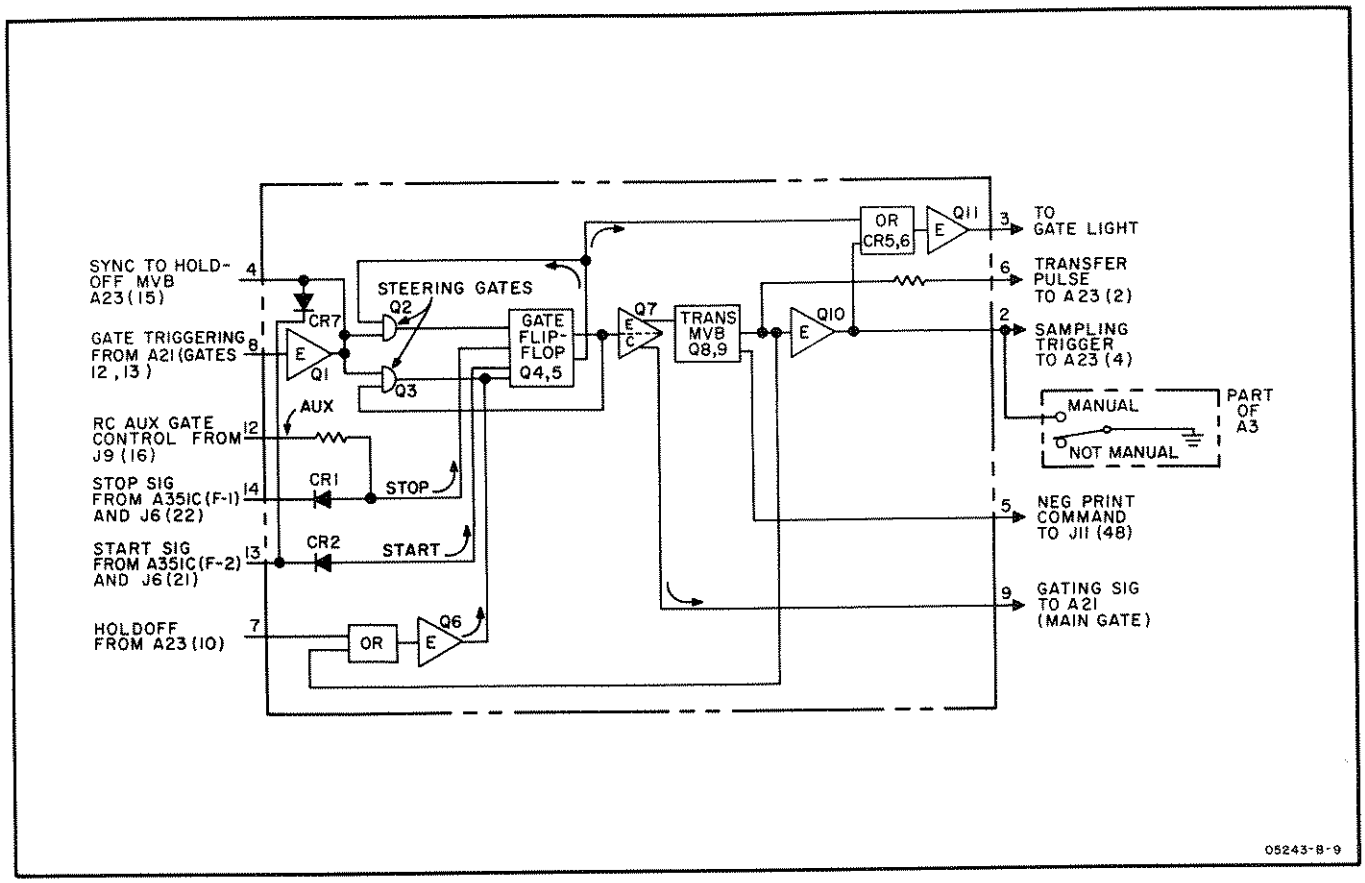


Figure 4-19. Gate Control Block Diagram

h. MULTI-PERIOD CHECK. Same as MULTI-PERIOD except that gate 5 is off and gate 3 is on so that the selected frequency (always 100 kc) from the first group of decade dividers becomes the driving signal for the second group of decade dividers.

4-92. CIRCUIT DETAILS. Refer to the schematic diagram, Figure 5-29, for circuit details. The basic AND gate description given in Paragraph 4-6 applies to the gate circuits, but note that gates 1 through 6 consist of two diodes arranged so that the gate signal must pass through both diodes. The gates are turned on (signal passes) when the -15 volts is removed so that the fixed bias supply (from +13 volts) reverse-biases the diodes. The main gate diode, CR9, is forward-biased and turned on when a positive control voltage is applied to the CR9 anode through Q6. Operation of the trigger circuits (Q2-Q3, Q10-Q11, and Q12-Q13) is discussed in Paragraphs 4-18 thru 4-20.

4-93. GATE CONTROL ASSEMBLY A22.

4-94. GENERAL. The main function of the gate control assembly is to generate the gating signal (which controls the main gate in A21) and the sampling trigger (which starts the sample-rate multivibrator in A23). Refer to the block diagram, Figure 4-19, during the following discussion.

4-95. SIGNAL FLOW. The gate flip-flop (Q4-Q5) is normally held in its off state (in this state, it holds the main gate closed, preventing counting) by the hold-off signal from A23 which is applied through Q6. The first gate triggering pulse which occurs after the end of the holdoff pulse is amplified by Q1 and steering amplifier Q2 and operates the gate flip-flop to its on state. The next gate triggering pulse turns the gate flip-flop off through Q1 and Q3. (In MANUAL operation -15 volts is applied as a start or stop signal thru CR1 or CR2 to turn the gate flip-flop on or off.) The gate flip-flop output (positive pulse) is amplified without inversion by split-load amplifier Q7 and passed on to A21 as the gating pulse. The trailing edge of the inverted output from Q7 triggers the transfer one-shot multivibrator (Q8-Q9) which produces a 30-millisecond output pulse; the negative pulse output is supplied directly from the multivibrator as the print command pulse (negative transition tells digital recorder to accept BCD information from counter); the positive pulse output from the multivibrator is a) immediately fed back to the gate flip-flop as a hold-off signal thru Q6 to prevent retriggering of the gate flip-flop until the regular holdoff signal from A23 is generated about a microsecond later, b) delivered to A23 for amplification as the transfer pulse, and c) amplified and inverted by Q10. The Q10 output is delivered to A23 as the sampling trigger pulse. (In MANUAL operation the sampling trigger output is shorted to ground by

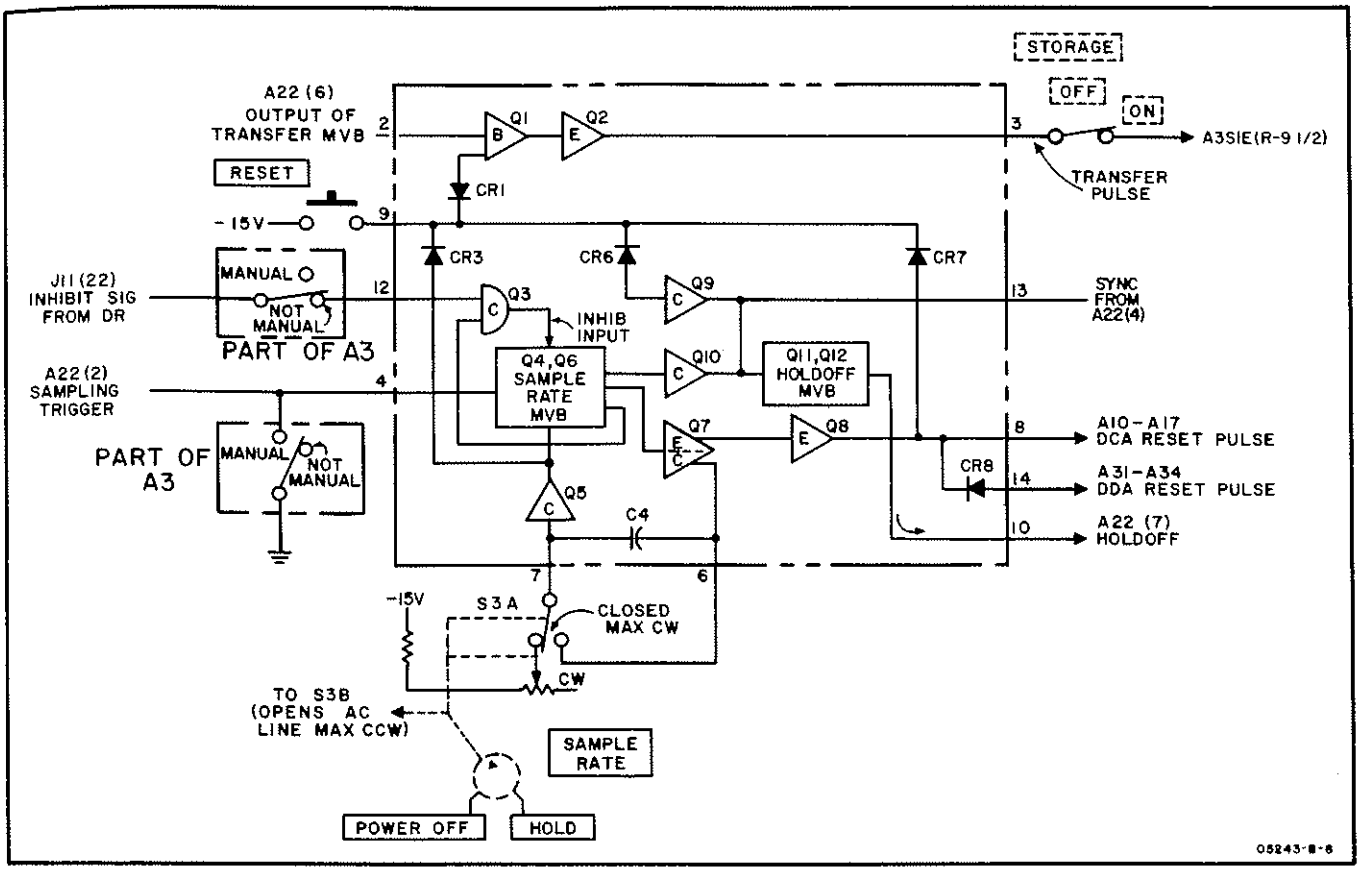


Figure 4-20. Sampling Control Block Diagram

the FUNCTION switch). The negative pulse outputs of both the gate flip-flop and amplifier Q10 are combined, then amplified by A11 to drive the front-panel GATE lamp; the GATE lamp is therefore on during the gating signal plus 30 milliseconds; this ensures a visible flash from the lamp even for very short gates.

4-96. CIRCUIT DETAILS. Refer to the schematic diagram, Figure 5-31, for circuit details. All circuits are conventional; flip-flop operation is described in Paragraphs 4-15 and 4-16, and one-shot multivibrator operation is described in Paragraphs 4-19 thru 4-22. The steering amplifiers (Q2 and Q3) are common-base amplifiers; one amplifier (whose collector is connected to the collector of the conducting flip-flop transistor) cannot operate because of low collector voltage; the other amplifier (whose collector is connected to the collector of the cut-off flip-flop transistor) amplifies the gate triggering pulse and supplies it to the receptive flip-flop transistor.

4-97. SAMPLING CONTROL ASSEMBLY A23.

4-98. GENERAL. During normal operation, the sampling control assembly receives the positive transfer pulse and the sampling trigger pulse from A22; its outputs are a) the amplified and inverted transfer pulse, b) reset pulses for the decimal counters and decade dividers, and c) the holdoff signal which prevents retriggering of the gate flip-flop in A22. Refer to the block diagram, Figure 4-20, during the following explanation.

4-99. TRANSFER PULSE. The positive transfer pulse is amplified without inversion by Q1, then amplified and inverted by Q2. During manual reset (RESET pushbutton pressed or FUNCTION or TIME-BASE switches operated) -15 volts is amplified and inverted by Q1, then amplified and inverted by Q2 to produce a manually generated equivalent of the transfer pulse. Action of other circuits resets all decimal counters to zero before the reset contacts open; then the voltage on the transfer pulse line transfers the zero count to the front-panel numerical display.

4-100. RESET. The negative transition of the sampling trigger pulse from A22 normally triggers the sample-rate one-shot multivibrator and starts operation of all sample-rate control circuits. Multivibrator feedback is through quick-recovery amplifier Q7, capacitor C4, and emitter follower Q5. The sample-rate output pulse duration is controlled by the SAMPLE RATE potentiometer and is variable between 55 milliseconds and 5 seconds. When the SAMPLE-RATE control is operated to the HOLD position (completely clockwise), the multivibrator provides a continuous output. An amplified output is taken from Q7, differentiated (leading edge is selected), amplified by Q8, and supplied as the DCA reset pulse and the DDA reset pulse. If manual reset occurs during the sample-rate multivibrator cycle, the multivibrator is quickly returned to its quiescent state as a result of the -15 volt input through CR3.

4-101. HOLDOFF. A second output from the sample-rate multivibrator is amplified by Q10 to drive the holdoff one-shot multivibrator (Q11-Q12). The holdoff multivibrator output consists of a positive pulse which normally begins about 1 microsecond after the end of the gating signal and ends 55 milliseconds after the end of the sample-rate pulse. A holdoff pulse is also generated as a result of manual reset (-15 volts from manual reset line through CR6 and Q9 to Q11-Q12) so that counting cannot start until after reset switching transients have ended.

4-102. CIRCUIT DETAILS. Refer to the schematic diagram, Figure 5-32, for circuit details. Inhibit amplifier Q3 is in series with the Q4 collector; inhibition of the sample-rate multivibrator occurs when Q3 is cut off by a positive inhibit signal (which effectively disconnects the Q4 collector). At the end of the multivibrator cycle, recovery amplifier Q7 conducts heavily to discharge C4 rapidly in preparation for the next cycle. Refer to Paragraphs 4-21 thru 4-24 for a basic one-shot multivibrator discussion.

4-103. OSCILLATOR AND OVEN A24, A25, A26.

4-104. GENERAL. Crystal oven assembly A24, oven control assembly A25, and the first portion of oscillator assembly A26 provide an extremely stable 1-Mc signal. The second portion of A26 amplifies and shapes either the internally generated 1 Mc, an externally supplied 1 Mc, or, for scaler operation, the output of the decimal counter A17 or A16. Refer to the schematic diagram, Figure 5-35, during the following explanation.

4-105. CRYSTAL OVEN ASSEMBLY A24. The crystal oven assembly is a thermally insulated chamber which contains a heating element, a temperature sensing circuit, and a 1-Mc piezo-electric crystal.

4-106. OVEN CONTROL ASSEMBLY A25. The oven control assembly includes oscillator A25Q1 which produces a 3-kc output whose amplitude is controlled by the temperature-sensing element in the oven. The oscillator output is amplified by A25Q2, detected to produce a DC level whose amplitude is inversely proportional to oven temperature. The DC level is amplified and applied to the heating element in the oven. The oven control assembly contains its own power supply which operates continuously whenever power is connected to the counter.

4-107. OSCILLATOR ASSEMBLY A26. The oscillator assembly includes the Q1 oscillator circuit which is connected to the 1-Mc crystal in A24. The 1-Mc oscillator output is amplified by A26Q2, A26Q3, and A26Q4. A portion of the A26Q4 output is detected and applied to A26Q1 as AGC so that power dissipation in the crystal can be held at a constant low value. Another portion of the A26Q4 output is supplied to the rear panel MODE switch where it usually is switched through to amplifier A26Q5 and trigger A26Q6-A26Q7. Outputs of 1 Mc are taken from both A26Q5 and A26Q6-A26Q7.

4-108. CIRCUIT DETAILS. Refer to the schematic diagram, Figure 5-35, for circuit details. The oscillator A25Q1 is controlled by the Wien bridge in A24. Positive feedback from the A25Q2 emitter through A24R1-A24C6 to the A25Q1 emitter maintains oscillation at the frequency of maximum feedback, which occurs at that frequency for which the A24R1-A24C6 phase shift equals the A24R2-A23C7 phase shift (about 3 kc). Degenerative feedback is provided from the A25Q2 emitter and the A24RT1-A24R3-A24R4 divider to the A25Q1 base; an increase in oven temperature lowers the resistance of RT1, thus increasing degenerative feedback and lowering oscillator output; likewise, a temperature decrease results in increased degenerative feedback to produce increased oscillator output. The detector is a voltage doubler circuit; A25C2 charges fully through the negative half cycle, and then discharges through A25CR2 in series with the driving source during the positive half cycle. Capacitor A25C4 between the collector and base of A25Q4 dampens sudden DC voltage swings and filters any AC component from the detected signal. The A26Q1 oscillator is a modified Pierce oscillator; its base is maintained at a DC level from the A26R1-A26R2 junction; AGC current is supplied to its emitter from the A26CR1-A26CR2 detector (voltage doubler) which is referenced to the A26R1-A26R2 junction. Limiter A26CR5 holds signal extremities to within about 0.6 volt of ground potential (see Paragraph 4-8). Operation of the trigger circuit (A26Q6-A26Q7) is discussed in detail in Paragraphs 4-15 through 4-18.

4-109. MULTIPLIER ASSEMBLY A27.

4-110. The 1-to-10-Mc multiplier assembly consists of X2 multiplier Q1, X5 multiplier Q2 and amplifier Q3. Circuit details are shown in the schematic diagram, Figure 5-37. Divider R4-R5 and emitter resistor R6 provide optimum DC bias to Q1 for efficient frequency doubling; likewise, divider R8-R9 and emitter resistor R10 provide optimum DC bias to Q2 for efficient fifth-harmonic generation. The interstage coupling transformers (L1-L2, L3-L4, and L5-L6) include capacitive dividers in their secondary circuits (C8-C9, C13-C14, and C19-C20) for interstage impedance matching.

4-111. 5-MC DECADE DIVIDER ASSEMBLY A28.

4-112. The 5-Mc decade divider assembly reduces the frequency of its input by a factor of ten (normally 1 Mc to 100 kc). Basic operation is identical to that described for the 5-Mc decimal counter (Paragraphs 4-75 through 4-78), except that there is no displayed count. Refer to the schematic diagram, Figure 5-39, for circuit details.

4-113. LOW-FREQUENCY DECADE DIVIDER ASSEMBLY A29-A34.

4-114. A block diagram of a typical decade divider is shown in Figure 4-15B. A decade divider is an arrangement of four cascaded binaries (flip-flop) so that for every ten input pulses there is one output

pulse. Consequently, when a frequency is applied to the input of the decade divider, the first binary divides it by two (since the first pulse switches the binary to the opposite state and a second pulse is required to return it to its original state) and again by two in the second binary (making a total division by four) and so on, with an expected total division of sixteen at the output of the fourth binary. The desired division by ten is obtained by a feed-ahead pulse to the fourth binary and feedback pulses to the second and third binaries. Therefore, after the eighth input pulse is received the binaries will be in a state as if they had counted fourteen pulses. Then, when the ninth and tenth pulses are received the desired final output pulse is produced. Operation is similar to that described for the decimal counters discussed in Paragraphs 4-75 and 4-76 except that there is no display array connected to the binaries. Note that A31 through A34 are supplied with a reset input so that only a certain number of input pulses to the decade dividers are necessary after reset before an output is produced. Refer to the schematic diagram Figure 5-41, for circuit details.

4-115. TIME-BASE CONTROL ASSEMBLY A35.

4-116. GENERAL. The purpose of the time-base control is to a) lower the output impedance of the 10 Mc signal from multiplier A27; b) select a frequency between 0.1 cps and 10 Mc as controlled by the TIME BASE switch, and c) provide a multiplied period signal when the FUNCTION switch selection is between 10 and 100K PERIOD AVERAGE. Inhibit gates 7 thru 11 (CR8, CR11, CR14, CR17, and CR20) are normally open; a control voltage to turn one of these gates off is applied only for multiplied period measurement. Multi-period gates 7 thru 11 (CR9, CR12, CR15, CR18, and CR21) are normally closed; one only is opened for multiplied period measurements. Selected frequency gates 21 thru 28 are controlled by the TIME-BASE switch.

4-117. SELECTED FREQUENCY CONTROL. For all operating functions except PERIOD AVERAGE CHECK, gates 21 thru 29 are on for the TIME BASE selections listed in Table 4-4. For example, if the TIME BASE switch is set to 1 ms, the control voltage is applied to gate 25, turning it on and permitting the 1-kc signal from A30 to be amplified by A11 and Q12; the amplified 1-kc is supplied as the selected frequency to A21.

Table 4-4. Normal Time Base Control

Gate Control On	Time Base Switch
21	10 s
22	1 s
23	0.1 s
24	10 ms
25	1 ms
26	0.1 ms
27	10 μs
28	1 μs
29	0.1 μs

(For PERIOD AVERAGE CHECK, gate 27 is on, regardless of TIME BASE selection, and 100 kc is supplied as the selected frequency.)

4-118. MULTIPLIED PERIOD CONTROL. Control voltages for gates 7 through 11 are supplied only for multiplied period measurements, as listed in Table 4-5. These control voltages select one to give steps of decade division for the period signal supplied by A21. Example 1: The FUNCTION switch is set to 10-PERIOD AVERAGE; gate control 11 is on, turning off inhibit gate 11 (to prevent further division of the signal from A26) and turning on multi-period gate 11; the amplified period signal from Q1 is passed thru CR21, divided by ten in A34, and supplied thru Q10 as the multiplied period signal. Example 2: The FUNCTION switch is set to 1K-PERIOD AVERAGE; gate control 9 is on, turning off inhibit gate 9 and turning on multi-period gate 9; the amplified period signal from Q1 is passed through CR15, divided by ten in A32, passed by CR17, divided in A33, passed by CR20, divided in A34, and supplied through Q10 as the multiplied period signal.

Table 4-5. Multiplied Period Control

Gate Control On	Function Switch
7	100K PERIOD AVE
8	10K PERIOD AVE
9	1K PERIOD AVE
10	100 PERIOD AVE
11	10 PERIOD AVE

4-119. GATING CONFLICT. A few combinations of TIME BASE and FUNCTION switch selections produce overlapping decade-divider requirements. For example, a TIME BASE selection of 0.1s and a FUNCTION selection of 10K-PERIOD AVERAGE turns on gate control 23 and gate control 8; the expected selected frequency of 10 cps is not supplied through CR16-Q7 since the frequency-dividing chain is blocked at CR11; the counter display is therefore meaningless. An alarm for unallowed switch combinations of this sort is given by the lighting of an asterisk (*) at the right end of the front panel display. The asterisk is also used to indicate two other non-useful control combinations: 1) TIME BASE of 0.1 μs and frequency FUNCTION, and 2) TIME BASE of 10 SEC and PERIOD function. The asterisk lamp (in A9) is controlled by switching contacts on both the TIME BASE and FUNCTION switches.

4-120. CIRCUITS. Refer to the schematic diagram, Figure 5-43, for circuit details. Most of the gates in A35 are of the type described in Paragraph 4-6, but gates 28 and 29 are two-diode AND gates, described in Paragraph 4-92. The inhibit gates (CR8, CR11, CR14, CR17, and CR20) are similar to conventional AND gates except that they are always on (forward-biased diode) in the absence of the control voltage and off (reverse-biased diode) when the control voltage is applied.

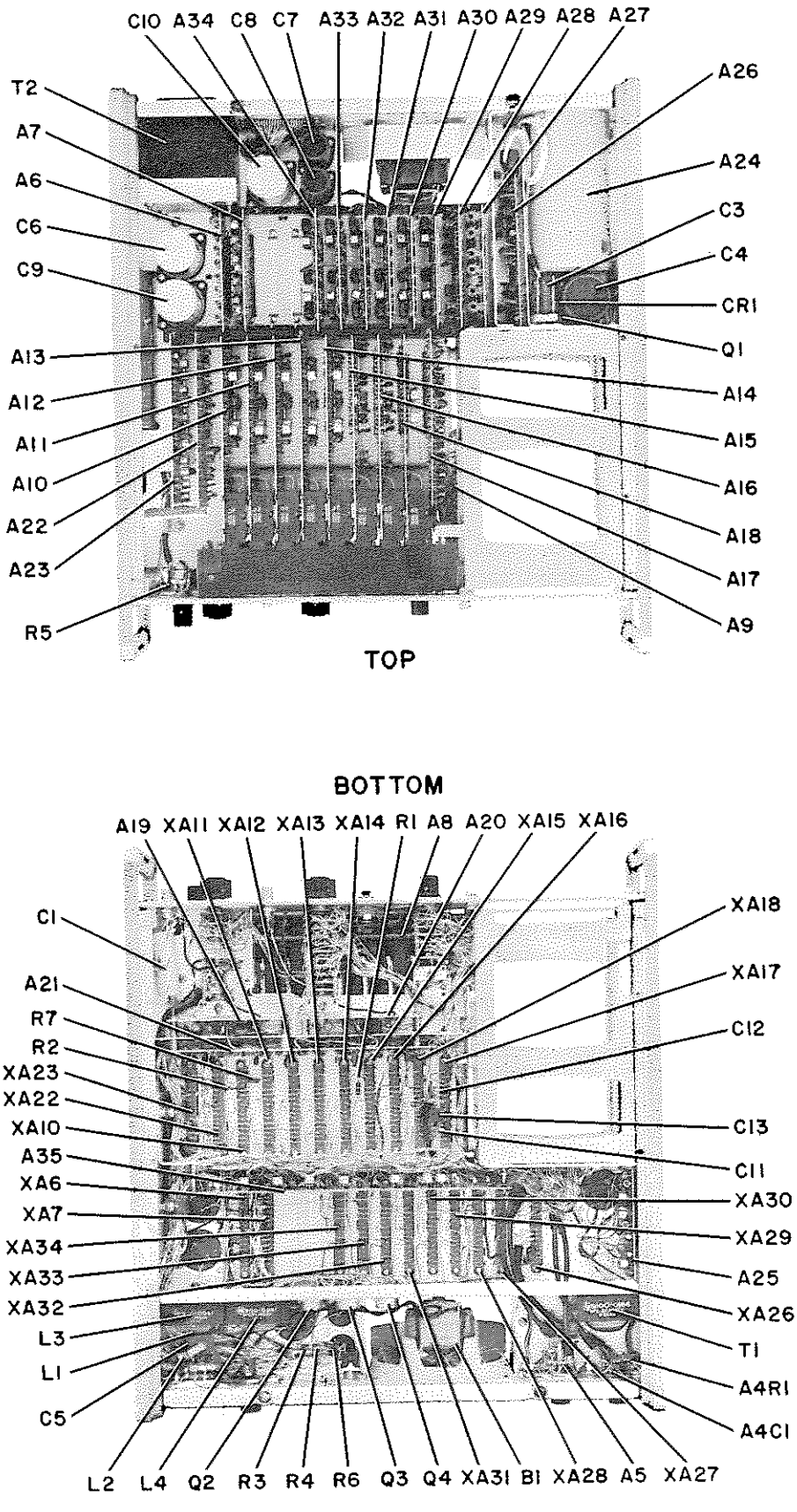


Figure 5-1. 5245L Component Location

SECTION V
MAINTENANCE

5-1. INTRODUCTION.

5-2. This section provides maintenance and service information for the Model 5245L Electronic Counter. Included are a table of recommended test equipment, troubleshooting procedures, repair and adjustment procedures, and an in-cabinet performance check which may be used to verify proper operation of the counter.

5-3. AIR FILTER.

5-4. Inspect the air filter (center of rear panel) regularly and clean it before it becomes dirty enough to restrict air flow. Proceed as follows:

a. Remove top cover (unlock the two quarter turn fasteners and slide cover to the rear).

b. Remove four screws holding filter in place.

c. Wash filter in warm water and detergent.

d. Remove cleaning solution from filter by shaking. Allow filter to dry completely.

CAUTION

DO NOT APPLY ANY COATING COMPOUND TO THE FILTER.

5-5. TEST EQUIPMENT.

4-6. Recommended test equipment for troubleshooting and performance checking is listed in Table 5-1. Test instruments other than those listed may be used if their specifications equal or exceed the required characteristics.

5-7. ASSEMBLY CONNECTION IDENTIFICATION.

5-8. Throughout the manual, connections to printed circuit assemblies are referred to in abbreviated form. For example, the connection to pin 15 of assembly A6 is A6(15).

CAUTION

TO AVOID DAMAGE, REMOVE POWER FROM INSTRUMENT BEFORE REMOVING OR REPLACING INSTRUMENT COVERS, ASSEMBLIES, OR COMPONENTS.

5-9. INSTRUMENT COVER REMOVAL.

5-10. To remove top or bottom cover, unlock two quarter turn fasteners which secure cover to instrument. Then slide cover toward rear of instrument. To replace cover, reverse procedure.

WARNING

115/230 VAC AND DC SUPPLY WIRES ARE EXPOSED WHEN EITHER TOP OR BOTTOM INSTRUMENT COVER IS REMOVED. EXERCISE CAUTION DURING TROUBLESHOOTING, ADJUSTMENT, OR REPAIR.

5-11. TROUBLESHOOTING AND REPAIR.

5-12. SELF-CHECK. When malfunction is suspected, disconnect all equipment from counter and perform self-check procedure given in Figure 3-4. If counter does not self-check properly, see Paragraphs 5-13 and 5-14. If counter self-checks properly, check that all inputs to counter are within the limits of counter specifications. For example, the input signal may be intermittent or have a small signal-to-noise ratio. Damaged connecting cables may be causing noise or intermittent connections. If malfunction still occurs, cause is internal to counter. Make performance checks (Paragraph 5-22) to help determine the source of trouble.

5-13. SUBSTITUTION. Troubleshooting may be greatly simplified if checking is done by replacing assembly suspected of malfunction with spare assembly known to be operating correctly. When the malfunctioning assembly is found, trouble then may be traced to individual components responsible for malfunction, or the malfunctioning assembly may be shipped to your Hewlett-Packard field office for repair.

5-14. TROUBLESHOOTING OF ASSEMBLIES. Refer to Section IV, Principles of Operation, for information on the operation of circuits. Table 5-2 gives the reference designations of all printed circuit assemblies used in the counter and their corresponding nomenclatures. Figure 5-1 shows the location of all assemblies and components used in Model 5245L. Tables 5-3, 5-4, 5-5, and Figures 5-3 and 5-4 contain troubleshooting aids. Consult the component location figures, signal waveforms, and voltages which are included with the assembly schematics at the rear of this section. For easy access to assembly circuits during operation, use the printed circuit assembly extension board provided with each instrument.

5-15. PRINTED CIRCUIT COMPONENT REPLACEMENT. Component lead holes in the Model 5245L circuit boards have plated walls to ensure good electrical contact between conductors on the opposite sides of the board. To prevent damage to this plating and to the replacement component, apply heat sparingly and work carefully. The following replacement procedure is recommended.

a. Remove defective component.

b. Melt solder in component lead holes. Use clean dry soldering iron to remove excess solder. Clean holes with toothpick or wooden splinter. Do not use metal tool for cleaning as this may damage through-hole plating.

Table 5-1. Recommended Maintenance Test Equipment

Instrument Type	Required Characteristics	Use	Instrument Recommended
Oscilloscope	50-Mc bandwidth, dual trace plug-in, ext sync capability	Observe waveforms during troubleshooting and adjustment	hp Model 175A Oscilloscope hp Model 1750A Dual Trace Vertical Amplifier hp AC-21C Voltage Divider Probe (two) hp 10003A 10:1 Probe
Test Oscillator	Continuously variable from 10 cps to 50 Mc 100 mv output	Performance Check	hp Model 204B Oscillator hp Model 606A Test Oscillator
Low Frequency Generator	Continuously variable from 2 cps to 10 cps, 100 mv output	Performance Check	hp Model 202A Low Frequency Function Generator
Pulse Generator	1 μsec wide, 1 v negative, 1 kc repetition rate	Performance Check	hp Model 212A Pulse Generator
Primary Standard Oscillator	100 kc or 1Mc sine wave, accuracy of ± 2 parts in 10^9	Check accuracy of counter time base	hp Model 103AR/104AR 113BR/115BR, 120AR, 724BR/725AR
Variable line voltage source with meter	Variable from 103 to 127 vac (207 to 253 vac)	Performance Check	
DC Voltmeter	0 V to $\pm$170 V 10 megohm input impedance 1% accuracy	Troubleshooting and adjustments	hp Model 412A

Table 5-2. Assembly Designations

A1	INPUT SWITCH ASSEMBLY (SENSITIVITY)
A2	TIME BASE SWITCH ASSEMBLY
A3	FUNCTION SWITCH ASSEMBLY
A4	MODE SWITCH ASSEMBLY
A5	OUTPUT SWITCH ASSEMBLY
A6	RECTIFIER ASSEMBLY
A7	REGULATOR ASSEMBLY
A8	DECIMAL POINT ASSEMBLY
A9	MEASUREMENT UNITS ASSEMBLY
A10-A14	LOW FREQUENCY DECIMAL COUNTERS
A15-A16	MEDIUM FREQUENCY DECIMAL COUNTER
A17	HIGH FREQUENCY DECIMAL COUNTER
A18	HIGH FREQUENCY READOUT
A19-A20	INPUT AMPLIFIER ASSEMBLIES
A21	FUNCTION CONTROL ASSEMBLY
A22	GATE CONTROL ASSEMBLY
A23	SAMPLING CONTROL ASSEMBLY
A24	CRYSTAL OVEN ASSEMBLY
A25	OVEN CONTROL ASSEMBLY
A26	OSCILLATOR ASSEMBLY
A27	MULTIPLIER ASSEMBLY
A28	MEDIUM FREQUENCY DECADE DIVIDER
A29-A34	LOW FREQUENCY DECADE DIVIDERS
A35	TIME BASE CONTROL ASSEMBLY

Table 5-3. Self Check

FUNCTION	TIME BASE	DISPLAYS	ASSEMBLIES CHECKED																	GATES CHECKED
			2	3	10	11	12	13	14	15	16	27	28	29	30	31	32	33	34	
Frequency	1 μs	00000010. Mc	x								x	x								3, 6, 28
	10 μs	0000010. 0 Mc	x							x	x	x	x							3, 6, 27
	.1 ms	000010. 00 Mc	x						x	x	x	x	x	x						3, 6, 26
	1 ms	00010000. kc	x					x	x	x	x	x	x	x	x					3, 6, 25
	10 ms	0010000. 0 kc	x				x	x	x	x	x	x	x	x	x	x				3, 6, 24
	.1 s	010000. 00 kc	x			x	x	x	x	x	x	x	x	x	x	x	x			3, 6, 23
	1 s	10000. 000 kc	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x		3, 6, 22
	10 s	0000. 0000 kc	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	3, 6, 21
Period Average	1	00000001		x									x	x						12, 27
	10	00000010		x							x		x	x	x					11, 13, 27
	100	00000100		x						x	x		x	x	x	x				10, 13, 27
	1K	00001000		x					x	x	x		x	x	x	x	x			9, 13, 27
	10K	00010000		x				x	x	x	x		x	x	x	x	x	x		8, 13, 27
	100K	00100000		x			x	x	x	x	x		x	x	x	x	x	x	x	7, 13, 27

The following assemblies are checked in all positions used in the Self-Check Table:

6, 7, 17, 18, 21, 22, 23, 24, 25, 26, and 35.

Assemblies 8 and 9 are checked in all Frequency Self-Checks.

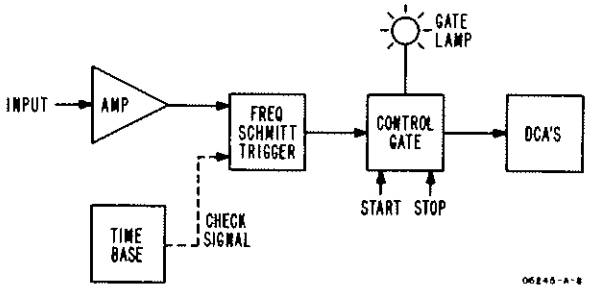
The SENSITIVITY switch (A1) is in the check position for all Self Check functions.

Assemblies 4, 5, 19, 20, are not checked in Self Check functions.

Assembly A26 is checked for operation, but not for accuracy or stability.

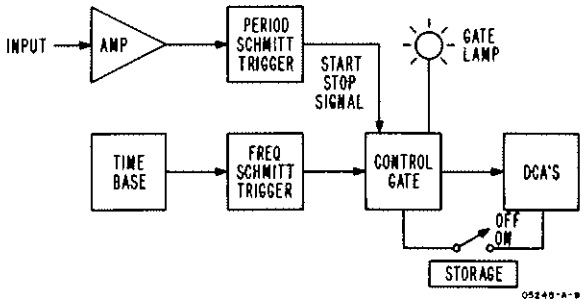
Table 5-4. Troubleshooting Symptoms

Totalizing or MANUAL START position is a mode of operation which will check basic counter circuits. Refer to Figure 3-8 for step-by-step procedure totalizing frequencies selected on TIME BASE switch. Verify counter operation by using all TIME BASE positions from .1 μs to 10 sec. If a malfunction occurs the symptoms listed below will isolate faulty circuit.



SYMPTOM	CHECK
Neon GATE indicator remains off in MANUAL START and DCA's are not counting.	1 2 3
Neon GATE indicator is on in MANUAL START and DCA's are not counting with any input signal 10 cps to 50 Mc, at 2V RMS in .1V position of SENSITIVITY switch.	4 5 6 7
Neon GATE indicator is on in MANUAL START and DCA's will count an external frequency of 1 Mc but will not count 1 μs TIME BASE in CHECK position.	8 9 10 11
MANUAL START position ; DCA's will count 1 μs TIME BASE in CHECK position but not following timing pulses. Defective 10 μs A28 .1 ms A29 1 ms A30 10 ms A31 .1 s A32 1 s A33 10 s A34 .1 μs A27	
MANUAL STOP, RESET pushbutton will not return displayed count to zero when pressed.	12

PERIOD measurement requires the period Schmitt trigger, transfer MVB, sample rate MVB, and reset amplifier to operate, in addition to the basic counter circuits required in the MANUAL mode.



Verify counter operation in 1 PERIOD AVERAGE position by setting TIME BASE switch to 1 μs and connecting a 1-kc signal to SIGNAL INPUT. (STORAGE switch in both OFF and ON position.) If a malfunction occurs the symptoms listed below will isolate faulty circuit.

SYMPTOM	CHECK
Neon GATE indicator remains off.	13 14 15
Neon GATE indicator flashes (use input signal at 10 cps) STORAGE switch OFF (rear of unit); display on DCA's increases approximately 100, 000 μs each gate time.	16 17
Neon GATE indicator flashes;correct display with STORAGE switch OFF. Incorrect display with STORAGE switch ON.	18
The PERIOD AVERAGE positions of 10, 100, 1K, 10K, and 100K require the multi-period trigger and GATE 7, 8, 9, 10, 11, and 13 to operate. Verify counter operation in all period positions using a 10-kc signal to SIGNAL INPUT. Note a 100K period average of 10 kc will require gate to be open for 10 seconds.	

SYMPTOM	CHECK
Neon GATE indicator remains off in 10 PERIOD position.	19 20 21 22

Table 5-4. Troubleshooting Symptoms (cont'd)

SYMPTOM		CHECK
Neon GATE indicator flashes in 10 PERIOD position but not one of following:	Defective	
100	A33 or GATE 10	23
1K	A32 or GATE 9	24
10K	A31 or GATE 8	25
100K	A30 or GATE 7	26

The ratio measurement is a mode of operation which requires all basic circuits of the counter to operate. Refer to Figure 3-7 for step-by-step procedure to measure ratio.

SYMPTOM	CHECK
Neon GATE flashes, but gives incorrect display	27

Table 5-5. Troubleshooting Checks

CHECK	POSSIBLE CAUSE	PROCEDURE	NORMAL READING	FAULTY CIRCUIT
1	Defective A3S1	Check voltage at pin 14, XA22	-15V	Switch contacts
2	Defective A22Q4, Q5, Q7	Check voltage at pin 9, XA22	+6V (1V in MANUAL STOP)	Gate flip-flop or Gate Ampl.
3	A22Q6, Q9, A23	Check voltage at pin 7, XA22	0V	Gate-Inhib Ampl or Holdoff MVB in A23
4	Defective A19 Input Ampl	Check voltage waveform on output of A19; use frequency of 100 kc or 1 Mc	10V p/p square wave	Input Ampl
5	Defective GATE 2	Output of GATE 2 (base of A21Q1)	6V p/p	A21CR1, or CR2
6	Defective A21 Function Control	Check waveform on gated signal to pin 13 of XA17	5V p/p, 10 ns neg pulse	A21, Q1 to Q8
7	Defective A17, 50 Mc Divider	Check waveform at pin 4, XA17	14V p/p, 20 ns pos pulse	A17
8	Defective A26 or A24	Check waveform at pin 11 and 12 of XA26	1.5V p/p signal	A26 or A24
9	Defective A26	Connect an external signal of 1 Mc at 1V RMS to EXT FREQ STD (1 Mc) jack at rear of unit; MODE switch in EXT. Check waveform on pins 11 & 12 of XA26.	1.5V p/p signal	A26, Q5, Q6, Q7
10	Defective A35 GATE 28 or A35Q12	Check waveform at EXT jack (front panel)	1V p/p	CR4, CR5, or Q12
11	Defective A21, GATE 1	Check waveform at base of A21 Q1	6V p/p	A21CR3, or CR4
12	A23, CR7	Check voltage at pin 8, XA23	-15V when button is pressed	A23CR7
13	Defective GATE 5, GATE 12 or PERIOD Schmitt trigger in A21	Check waveform at pin 8, XA22	2V pos pulse .1μs wide	A21CR10, CR11, CR14 or Q9, Q10, Q11
14	Defective A22	Check waveform at pin 9, XA22	5V p/p signal	A22, Q1, Q2, Q3
15	Defective A23	Check voltage at pin 7, XA22, with no signal input to counter	0V	A positive voltage indicates a defective holdoff MVB in A23 (Q11, Q12)

Table 5-5. Troubleshooting Checks (cont'd)

CHECK	POSSIBLE CAUSE	PROCEDURE	NORMAL READING	FAULTY CIRCUIT
16	No Reset, Defective A22	Check waveform at pin 2, XA22	8V, 35 ms neg pulse	A22, Q8, Q9, or Q10
17	No Reset, Defective A23	Check waveform at pin 8, XA23	30V, 10 μs neg pulse	A23, Q3 to Q8
18	No transfer pulse, Defective A23	Check waveform at pin 3, XA23, with STORAGE switch ON.	30V, 35 ms neg pulse	A23, Q1 or Q2
19	Defective A35Q1	Check waveform on collector of A35Q1 (1W resistor R2 in middle of board)	20V p/p square wave	A35Q1
20	GATE 11	Check waveform at pin 8, XA34	6V p/p signal	A35CR21
21	A34	Check waveform at pin 5, XA34	20V p/p signal	A34
22	Multi-period trigger, or GATE 13	Check waveform at pin 8, XA22	2V pos pulse .1 μs wide	A21, Q10, Q11 or CR15
23 24 25 26		Check input and output waveforms of: A33 A32 A31 A30		
27	Defective A20	Check waveform on output of A20	1.5V p/p sinewave; input signal @ 100 mv level	A20

c. Bend lead of replacement component to the correct shape and insert component leads into component lead holes. Using heat and solder sparingly, solder leads in place. Heat may be applied to either side of board. A heat sink (longnose pliers, commercial heat-sink tweezers, etc) should be used when replacing transistors and diodes in order to prevent conduction of excessive heat from the soldering iron to the component.

d. Through-hole plating breaks are indicated by the separation from the board of the round conductor pad on either side of the board. To repair breaks, press conductor pads against board and solder replacement component lead to conductor pad on both sides of the board.

5-16. ADJUSTMENTS.

5-17. REGULATOR A7.

CAUTION

When troubleshooting or adjusting the power supply, do not short supplies to ground or to each other. This will damage the diodes and transistors.

a. Set line voltage to normal value (115 or 230 vac).

b. Connect DC voltmeter (Table 5-1) to A7 (1).

c. Voltmeter should read +20 vdc ±0.5 vdc. If voltage is outside this range, adjust A7R17 (Figures 5-14 and 5-15).

d. Vary line voltage from 103 to 127 vac (207 to 255 vac). The +20 vdc supply should not vary more than 0.5 vdc.

e. Check all supply voltages at locations, and under conditions shown in Table 5-6.

Note

Input sensitivity levels must be rechecked if power supply voltages are readjusted.

5-18. INPUT AMPLIFIER (SENSITIVITY).

a. Set 1) SENSITIVITY switch to .1V; 2) TIME BASE switch to 10 ms; 3) FUNCTION switch to FREQ.

b. Connect voltmeter (Table 5-1) to DC SIGNAL INPUT.

c. Adjust A19R4 (Figure 5-26 and 5-27) to obtain a reading on the voltmeter of 0 volts ±5 mv.

d. Apply 100 mv, 50 Mc signal from test oscillator (Table 5-1) through a 50-ohm termination to the AC SIGNAL INPUT.

e. Adjust A19R7 until gate light blinks on and off. Alternately decrease the output of the oscillator and adjust A19R7 until maximum sensitivity is obtained.

f. Vary frequency to 50 Mc. Gate should continue to blink on and off over the frequency range.

g. Check sensitivity levels in PERIOD AVERAGE positions.

Table 5-6. Power Supply Voltages

Test Point	Line Voltage			Adjustment
	103	115	127	
A6(15)	-120 ±10	-130 ±10	-150 ±10	None
A6(12)	+160 ±10	+170 ±10	+180 ±10	None
A7(13)	- 15 ±.5	- 15 ±.5	- 15 ±.5	R5
A7(4)	+ 13 ±.5	+ 13 ±.5	+ 13 ±.5	R12
A7(1)	+ 20 ±.5	+ 20 ±.5	+ 20 ±.5	R17
A7(8)	-6.9 ± 1	-6.9 ± 1	-6.9 ± 1	Depends on adjustment of +20 vdc and -15vdc above
A7(10)	+17.6 ± 1	+17.6 ± 1	+17.6 ± 1	

5-19. RATIO INPUT AMPLIFIER A20 (SENSITIVITY).

a. Set 1) SENSITIVITY to 1 V; 2) TIME BASE switch to EXT; 3) FUNCTION switch to 1 PERIOD AVERAGE.

b. Connect voltmeter (Table 5-1) to EXT. TIME BASE BNC.

c. Adjust A20R4 (Figure 5-26 and 5-27) to obtain a reading on the voltmeter of 0 volts ±5 mv.

d. Set OUTPUT switch on rear panel to 100 cps, and connect cable from OUTPUT BNC to AC SIGNAL INPUT BNC.

e. Apply 100 mv, 50 Mc signal from test oscillator (Table 5-1) through a 50 Ω termination to EXT. TIME BASE BNC.

f. Adjust A20R7 until correct count (oscillator frequency - 100) appears on the 5245L. Alternately decrease the output of the oscillator and adjust A20R7 until maximum sensitivity is obtained.

5-20. OSCILLATOR CALIBRATION (Figure 5-3).

a. Trigger the oscilloscope (Table 5-1) from 100 kc house standard or 103A/104A Quartz Oscillator.

b. Observe 1 Mc signal from OUTPUT STD FREQ BNC on rear panel of 5245L.

c. Adjust COARSE FREQUENCY capacitor from rear panel until pattern on the oscilloscope stops drifting.

d. If necessary adjust MED or FINE FREQ ADJ (at rear of plug-in compartment) until average drift of oscilloscope pattern is zero.

5-21. OSCILLATOR LEVEL. The rms voltage between pin 2-3 and pin 2-1 of A26 should be 5 to 7 mv. If not, adjust by changing value of A26R1. If it is necessary to adjust A26R1 to the point where the DC collector current of A26Q1 exceeds 0.75 ma (more than 0.75 volts across A26R7), look for trouble in the oscillator circuit.

5-22. IN-CABINET PERFORMANCE CHECK.

5-23. GENERAL. The following performance check verifies proper operation of all circuits in the Model 5245L Electronic Counter and may be used:

a. as part of an incoming inspection check of instrument specifications;

b. periodically, for instruments used in systems where maximum reliability is of utmost importance;

c. as part of a troubleshooting procedure to locate malfunctioning circuits, and

d. after any repairs or adjustments, before returning instrument to regular service.

5-24. VARIABLE LINE VOLTAGE. During the following tests, counter should be connected to power source through a variable voltage device so that line voltage may be varied ±10% from nominal (115 or 230 vac) to assure proper operation of counter under various supply conditions.

5-25. TIME-BASE OSCILLATOR FREQUENCY.

5-26. GENERAL. The frequency accuracy of the oscillator may be determined by observing the rate of drift of the oscilloscope pattern (Figure 5-2). If the pattern moves to the right, counter oscillator frequency is lower than the standard frequency being used to trigger the oscilloscope. If the pattern moves to the left, oscillator frequency is high. The reciprocal of the time in seconds for the oscilloscope pattern to move the width of one cycle equals the frequency difference in parts in 10^6 with 1-Mc inputs (or parts in 10^5 with 100-kc inputs). For example, if the oscilloscope pattern drifts to the left a rate of one cycle's width every 10 seconds with 1-Mc inputs, the oscillator frequency is 1 part in 10^7 high. If the pattern moves the width of one cycle in 100 seconds, frequency error is 1 part in 10^9 with 10-Mc inputs. If the pattern moves the width of one cycle in 10 seconds with a 10-Mc input, the frequency error is 1 part in 10^8. Movement of the pattern may be accurately checked using an oscilloscope with calibrated sweeps by timing the movement of the point at which the oscilloscope trace crosses the base line when horizontal sweep is expanded and vertical gain is increased.

5-27. To check oscillator frequency, proceed as follows:

a. Connect oscilloscope to OUTPUT STD FREQ BNC and set MODE switch to INT STD FREQ.

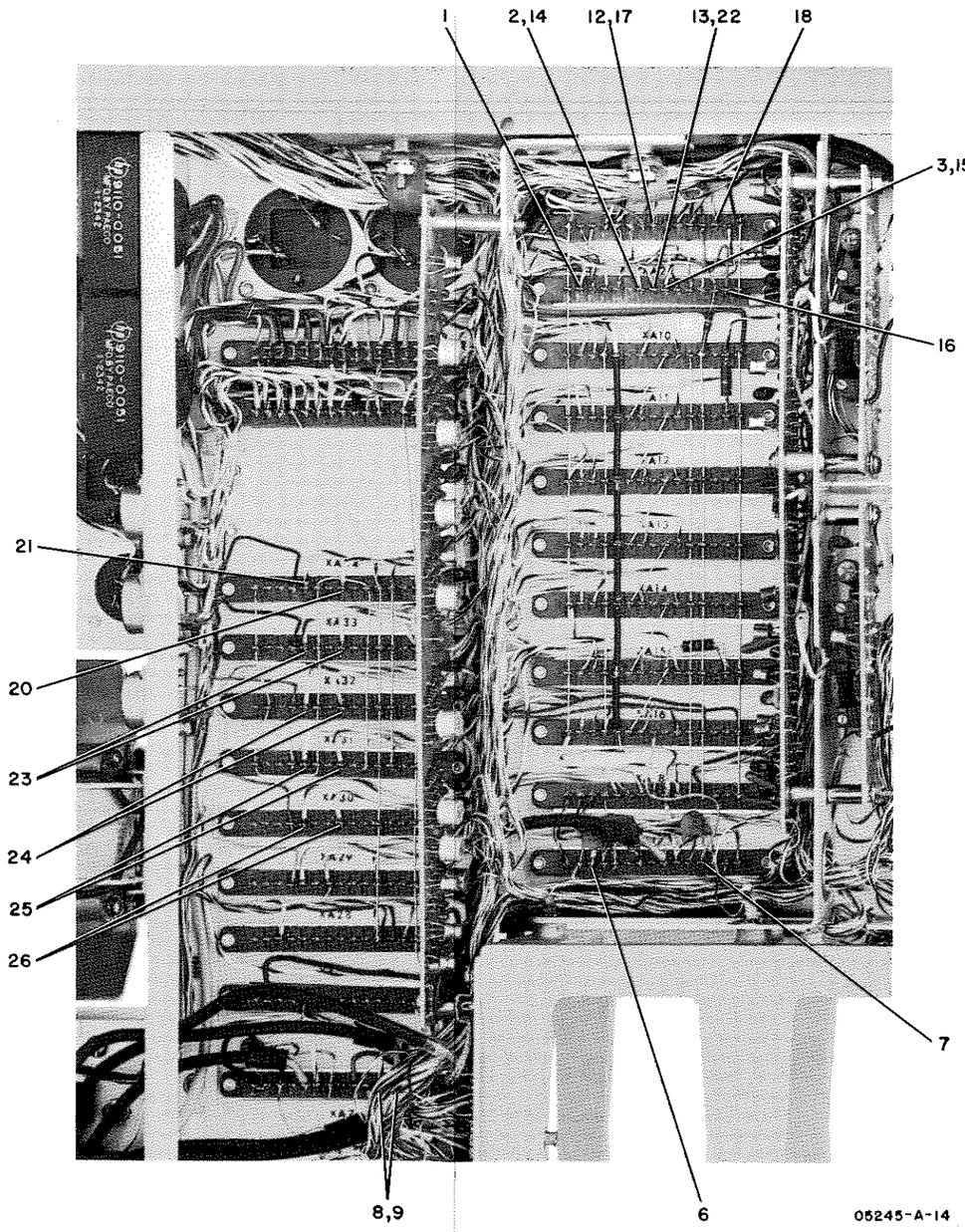


Figure 5-2. Test Point Locations

b. Trigger oscilloscope externally with a 1-Mc signal from a standard frequency source.

c. Set oscilloscope sweep time to .1 μs/cm. Adjust oscilloscope controls to obtain a presentation of a 5 v peak-to-peak nonsinuoidal waveform.

d. Horizontal drift of oscilloscope display in cm/sec is difference between standard frequency and counter time-base frequency in parts in 10^7.

e. Determine frequency difference in parts in 10^7 and record.

f. If frequency difference is excessive for the desired application of counter, see Paragraph 5-20 for time-base oscillator frequency adjustment procedure.

g. Note and record environmental temperature.

h. Repeat above steps a through g at daily intervals. Change in frequency difference between standard frequency and time-base oscillator frequency per day is frequency drift of time-base oscillator. Drift should not exceed ±3 parts in 10^9 per day under reasonably constant environmental conditions (see Table 1-1).

5-28. SIGNAL INPUT SENSITIVITY.

a. Set SIGNAL INPUT SENSITIVITY switch to .1v, TIME BASE switch to .1 μ s, and FUNCTION switch to PERIOD.

b. Connect output of test oscillator (Table 5-1) to input of counter and to input of oscilloscope.

c. Vary frequency of test oscillators from 2 cps to 20 Mc, keeping output constant at 100 mv rms. Counter should display both frequency and period at frequencies within this range as specified in Table 1-1 of specifications. Three or four spot checks across the band are sufficient.

5-29. EXTERNAL TIME BASE INPUT SENSITIVITY.

a. Set SIGNAL INPUT SENSITIVITY switch to 1v, TIME BASE switch to EXT., and FUNCTION switch to 1 PERIOD AVERAGE.

b. Apply f_2 (any frequency between 0 and 1 Mc) to AC SIGNAL INPUT BNC from test oscillators or OUTPUT STANDARD FREQUENCY BNC (rear panel).

c. Apply f_1 (any frequency between 0 and 20 Mc) to TIME BASE EXT. BNC using test oscillators. Counter should display f_1/f_2 over range listed in Table 1-1 of specifications.

5-30. DECIMAL COUNTER CHECK (A10-A18).

5-31. With INPUT switch set to CHECK observe display for the following symptoms:

a. Faulty display of a group of digits at left end of display. Indicates defective counter at right end of faulty display group.

b. Faulty display in a single column. Indicates display circuits (not the counting circuits) for that board may be defective.

Note

Normal output pulse from decimal counter assemblies is a 26- to 28-volt rectangular wave.

5-32. GATE CONTROL AND SAMPLING CONTROL CHECKS (A22-23).

5-33. The following symptoms indicate trouble in A22 or A23:

a. SAMPLE RATE control fails to control sampling rate over its full range (0.1 sec to 5 sec).

b. New count fails to transfer to visual display.

c. Counter fails to reset to zero before each count (STORAGE switch OFF on rear panel).

d. Gate lamp operates continuously (A22 only).

e. Display fails to change to zero and start new count when RESET pushbutton is depressed and released (A23 only).

5-34. DECADE DIVIDER CHECKS (A28-A34).

5-35. Using a 10:1 probe (Table 5-1) connect oscilloscope to the OUTPUT STANDARD FREQ BNC on rear panel and observe the waveforms for different positions of the OUTPUT switch. The waveforms should be similar to those shown in Figure 5-13. Condition of the counter is given in Note 7.

5-36. Using a 10:1 probe (see Table 5-1) connect oscilloscope to the TIME BASE EXT. BNC on front panel and observe waveforms for different positions of the TIME BASE switch. The waveforms should be similar to those shown in Figure 5-9. Set up the counter as shown in Note 6 on Figure 5-9. The condition of the oscilloscope is noted alongside each waveform.

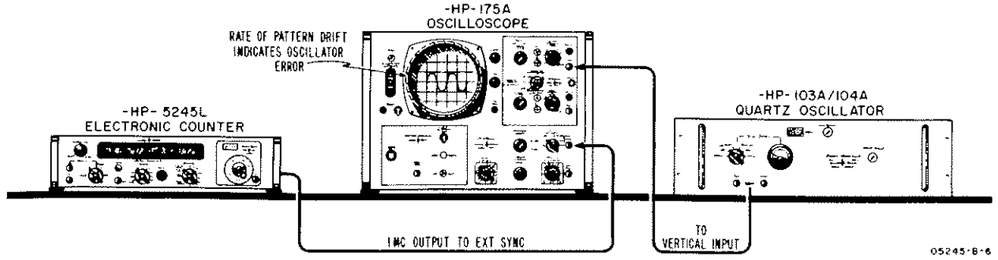


Figure 5-3. Test Setup for Checking Oscillator Frequency

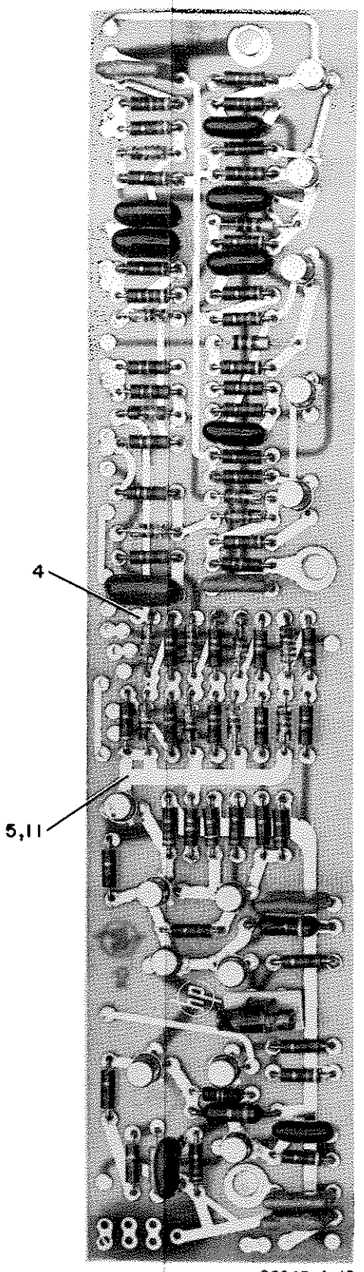
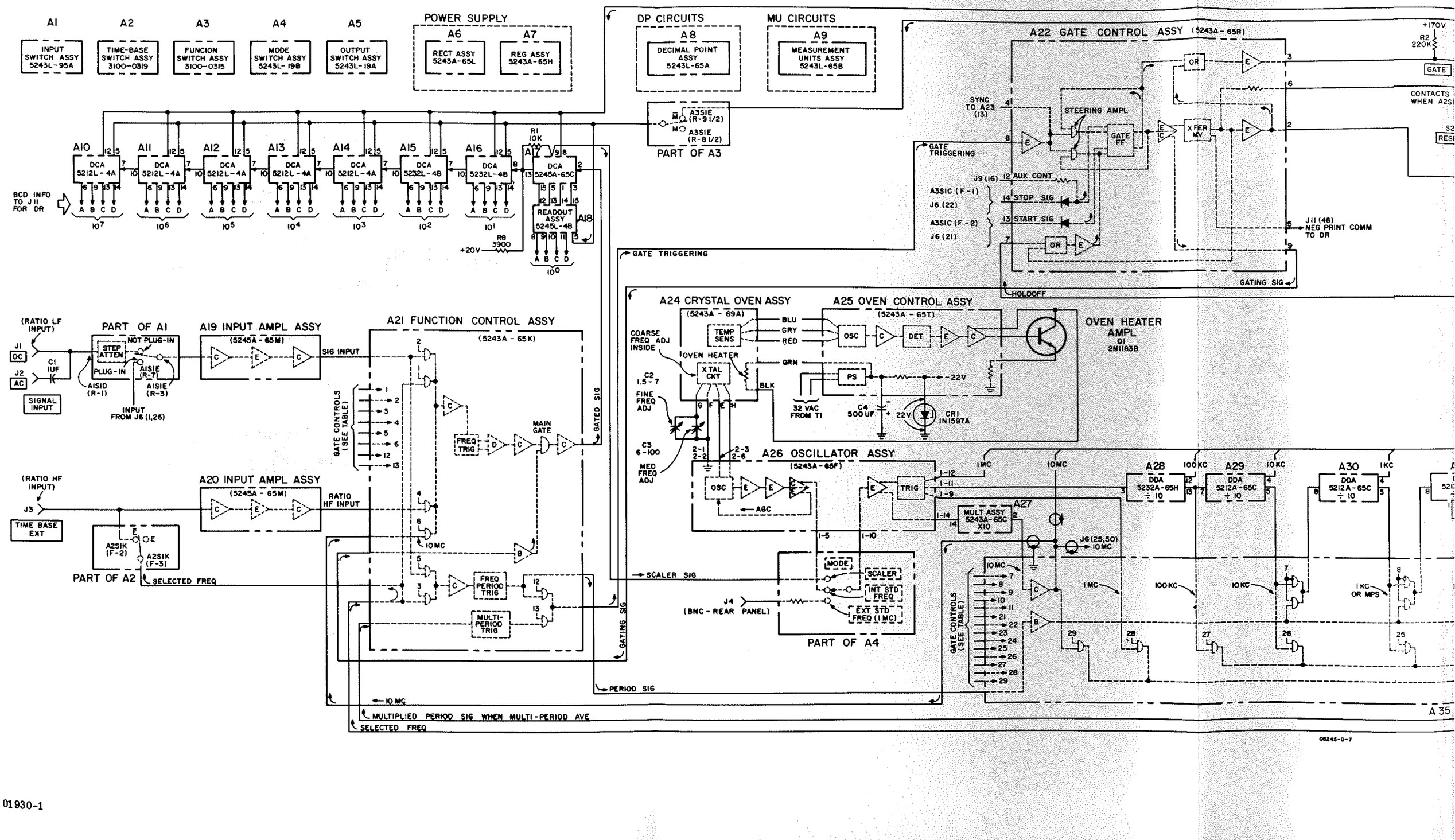
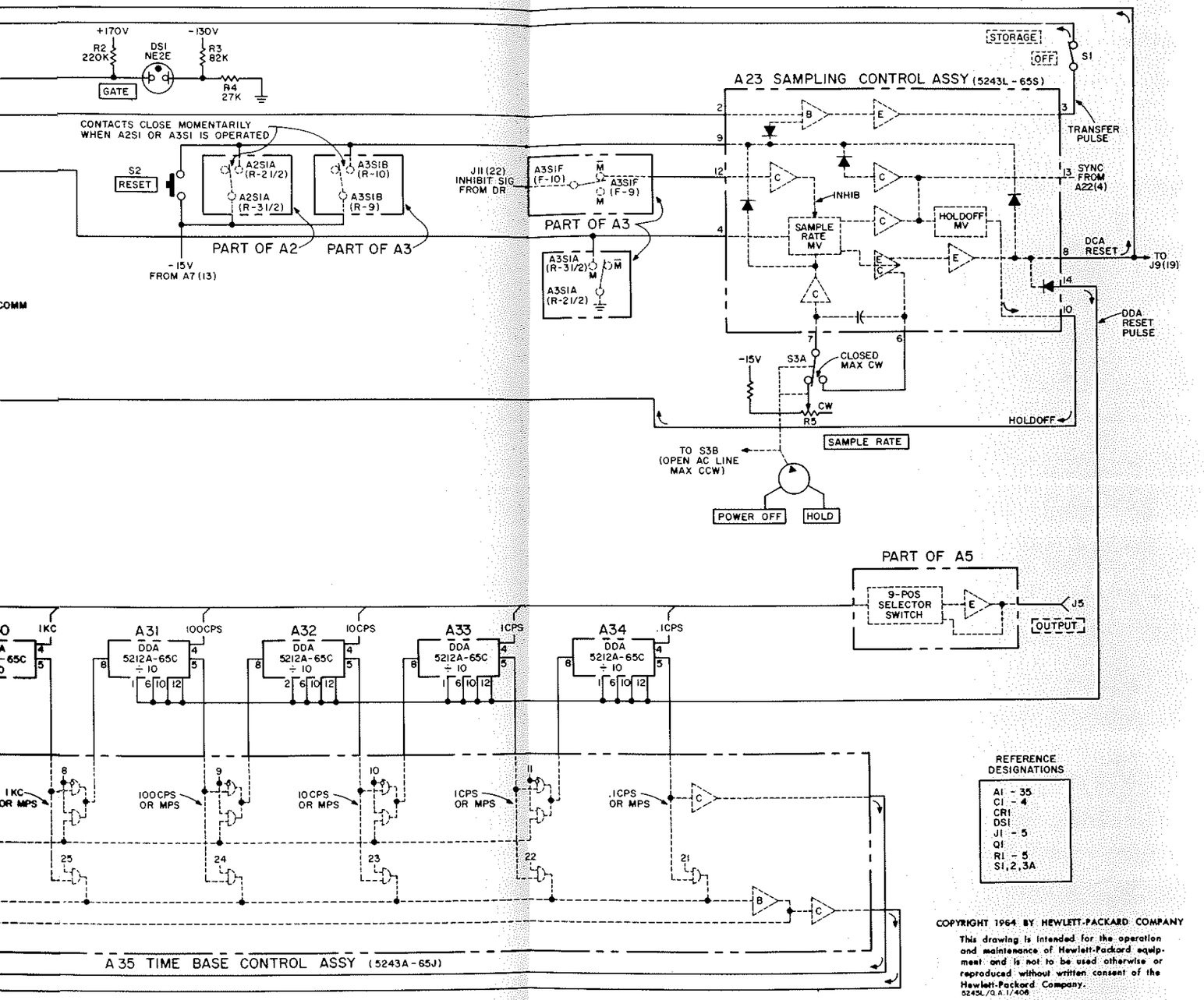


Figure 5-4. A21 Test Point Locations


A1
INPUT SWITCH ASSY 5243L-95A
A2
TIME-BASE SWITCH ASSY 3100-0319
A3
FUNCION SWITCH ASSY 3100-0315
A4
MODE SWITCH ASSY 5243L-198
A5
OUTPUT SWITCH ASSY 5243L-19A
POWER SUPPLY
A6
RECT ASSY 5243A-65L
A7
REG ASSY 5243A-65H
DP CIRCUITS
A8
DECIMAL POINT ASSY 5243L-65A
MU CIRCUITS
A9
MEASUREMENT UNITS ASSY 5243L-65B
A10 DCA 5212L-4A
A11 DCA 5212L-4A
A12 DCA 5212L-4A
A13 DCA 5212L-4A
A14 DCA 5212L-4A
A15 DCA 5232L-48
A16 DCA 5232L-48
A17 DCA 5245A-65C
A18 READOUT ASSY 5245L-48
BCD INFO TO J11 FOR DR
R1 10K
R8 3900
+20V
A3SIE (R-9 1/2)
A3SIE (R-8 1/2)
PART OF A3
A22 GATE CONTROL ASSY (5243A-65R)
+17OV
R2 220K
GATE
SYNC TO A23 (13)
STEERING AMPL
GATE FF
XFER MV
OR
GATE TRIGGERING
J9 (16) 12 AUX CONT
A3SIC (F-1) J6 (22)
14 STOP SIG
A3SIC (F-2) J6 (21)
13 START SIG
J11 (48) NEG PRINT COMM TO DR
GATING SIG
HOLDOFF
CONTACTS WHEN A2SI
S2 RESI
(RATIO LF INPUT)
J1 DC
J2 AC
SIGNAL INPUT
C1 1UF
PART OF A1
STEP ATTEN
NOT PLUG-IN
PLUG-IN
A1SID (R-1)
A1SIE (R-7)
A1SIE (R-3)
INPUT FROM J6 (1,26)
A19 INPUT AMPL ASSY (5245A-65M)
SIG INPUT
A21 FUNCTION CONTROL ASSY (5243A-65K)
GATE CONTROLS (SEE TABLE)
FREQ TRIG
MAIN GATE
GATED SIG
GATING SIG
(RATIO HF INPUT)
J3
TIME BASE EXT
A20 INPUT AMPL ASSY (5245A-65M)
RATIO HF INPUT
A2SIK (F-2)
A2SIK (F-3)
PART OF A2
SELECTED FREQ
10MC
FREQ PERIOD TRIG
MULTI-PERIOD TRIG
SCALER SIG
PERIOD SIG
MULTIPLIED PERIOD SIG WHEN MULTI-PERIOD AVE
SELECTED FREQ
A24 CRYSTAL OVEN ASSY (5243A-69A)
TEMP SENS
BLU
GRY
RED
COARSE FREQ ADJ INSIDE
OVEN HEATER
XTAL CKT
GRN
BLK
FINE FREQ ADJ
C2 1.5-7
C3 6-100
MED FREQ ADJ
32 VAC FROM T1
A25 OVEN CONTROL ASSY (5243A-65T)
OSC
DET
PS
-22V
C4 500 UF
22V
CR1 IN1597A
OVEN HEATER AMPL Q1 2N1183B
A26 OSCILLATOR ASSY (5243A-65F)
AGC
TRIG
A27 MULT ASSY 5243A-65C X10
J6 (25,50) 10MC
MODE
SCALER
INT STD FREQ
EXT STD FREQ (1MC)
J4 (BNC-REAR PANEL)
PART OF A4
A28 DDA 5232A-65H ÷10
A29 DDA 5212A-65C ÷10
A30 DDA 5212A-65C ÷10
1MC
10MC
100KC
10KC
1KC OR MPS
A35
08245-0-7

01930-1



REFERENCE DESIGNATIONS

AI	35
CI	4
CRI	
DSI	
JI	5
QI	
RI	5
SI,2,3A	

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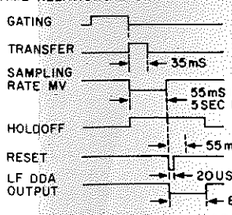
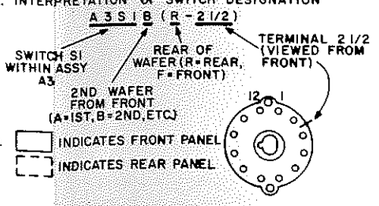
NOTES

1. SYMBOLS
   - COMMON EMITTER AMPLIFIER
   - COMMON BASE AMPLIFIER
   - COMMON COLLECTOR AMPLIFIER (EMITTER FOL)
   - SPLIT LOAD AMPLIFIER
   - AND GATE, NUMBER INDICATES CONTROL; ON STATE REQUIRES -15V CONTROL; SEE TABLE
   - INHIBIT GATE; OFF STATE REQUIRES -15V CONTROL; SEE TABLE
2. GENERAL ABBREVIATIONS
   - DP = DECIMAL POINT
   - DR = DIGITAL RECORDER
   - GC = GATE CONTROL
   - MU = MEASUREMENT UNIT
   - BCD = BINARY CODED DECIMAL
   - DCA = DECIMAL COUNTER ASSY
   - DDA = DECADE DIVIDER ASSY
   - MPS = MULTIPLIED PERIOD SIG
3. SWITCH SITUATION ABBREVIATIONS
   - · = AND
   - + = OR
   - C = INPUT SWITCH: CHECK
   - $\bar{C}$ = INPUT SWITCH: NOT CHECK
   - E = TIME BASE SWITCH: EXT
   - $\bar{E}$ = TIME BASE SWITCH: NOT EXT
   - F = FUNCTION SWITCH: FREQUENCY
   - M = FUNCTION SWITCH: MANUAL START OR MANUAL STOP
   - $\bar{M}$ = FUNCTION SWITCH: NOT (MANUAL START OR MANUAL STOP)
   - P = FUNCTION SWITCH: PERIOD AVERAGE (FOR ANY POSITION)
   - P_A = FUNCTION SWITCH: PERIOD AVERAGE (FOR SPECIFIC POSITION)
   - R = FUNCTION SWITCH: REMOTE OR TIME INT
   - $\bar{R}$ = FUNCTION SWITCH: NOT (REMOTE OR TIME INT)
4. DP LAMPS ARE DESIGNATED 0 THRU 7 FOR EACH POSITION FROM RIGHT TO LEFT AS VIEWED FROM FRONT
5. DP AND MU LAMPS OPERATE AS TABULATED WHEN INPUT SWITCH IS NOT CHECK; LAMPS OPERATE IN CHECK ONLY IF FUNCTION SWITCH IS SET TO FREQUENCY
6. DP AND MU LAMPS ARE LIGHTED BY +170V CONTROL SUPPLIED TO APPROPRIATE A8 - A9 TERMINAL FROM SWITCH OR J10
7. TIME RELATIONSHIPS



8. INTERPRETATION OF SWITCH DESIGNATION


A3S1B (R-2 1/2)
SWITCH S1 WITHIN ASSY A3
REAR OF WAFER (R=REAR, F=FRONT)
TERMINAL 2 1/2 (VIEWED FROM FRONT)
2ND WAFER FROM FRONT (A=1ST, B=2ND, ETC.)
12
1

9. INDICATES FRONT PANEL
   INDICATES REAR PANEL

08245-D-8

GATE CONTROL SUMMARY (NOTE 3)

GATE CONTROL DESIGNATION	INTERNAL CONTROL: SWITCH SITUATION FOR ON STATE (-15V), WITH (PLUG IN OFF)	INTERNAL CONTROL: SOURCE	REMOTE CONTROL (J9 PIN NO.)
1	$(M\cdot\bar{E}\cdot C)+(P\cdot E\cdot C)+(P\cdot\bar{E})$	A1S1C (F-5)	1
2	$(M+F)\cdot\bar{C}$	A1S1B (R-2)	2
3	$(F\cdot\bar{E})+(P\cdot C)$	A3S1C (R-5)	3
4	$(M+F)\cdot E+(P\cdot E\cdot\bar{C})$	A2S1A (F-3)	4
5	$P\cdot\bar{C}$	A1S1A (R-8)	5
6	$F\cdot\bar{E}\cdot C$	A1S1A (F-2)	6
7	100K P_A	A3S1A (F-9)	7
8	10K P_A	A3S1A (F-8)	8
9	1K P_A	A3S1A (F-7)	9
10	100P_A	A3S1A (F-6)	10
11	10P_A	A3S1A (F-5)	11
12	$F+1P_A$	A3S1A (F-3,4)	12
13	ANY P_A EXCEPT 1P_A	A3S1A (R-9 1/2)	13
21	(10S)·(M+F+P·$\bar{C}$)	A2S1A (F-4)	21
22	(1S)·(M+F+P·$\bar{C}$)	A2S1A (F-5)	22
23	(0.1S)·(M+F+P·$\bar{C}$)	A2S1A (F-6)	23
24	(10mS)·(M+F+P·$\bar{C}$)	A2S1A (F-7)	24
25	(1mS)·(M+F+P·$\bar{C}$)	A2S1A (F-8)	25
26	(0.1mS)·(M+F+P·$\bar{C}$)	A2S1A (F-9)	26
27	(10US)·(M+F+P)+(P·C)	A2S1A (F-10)	27
28	(1US)·(M+F+P·$\bar{C}$)	A2S1A (F-11)	28
29	(0.1US)·(M+F+P·$\bar{C}$)	A2S1A (F-12)	29

DECIMAL POINT SITUATIONS (NOTES 3,4,5,6)

FUNCTION SWITCH	TIME BASE SWITCH: 0.1US	1US	10US	0.1mS	1mS	10mS	0.1S	1S	10S	EXT
M START	–	–	–	–	–	–	–	–	–	–
M STOP	–	–	–	–	–	–	–	–	–	–
F	–	0	1	2	0	1	2	3	4	–
$1P_A$	1	0	2	1	0	2	1	0	–	0
$10P_A$	2	1	0	2	1	0	2	1	–	1
$100P_A$	3	2	1	0	2	1	0	–	–	2
1KP_A	4	3	2	1	0	2	–	–	–	3
10KP_A	5	4	3	2	1	–	–	–	–	4
100KP_A	6	5	4	3	–	–	–	–	–	5
R	–	–	–	–	–	–	–	–	–	–

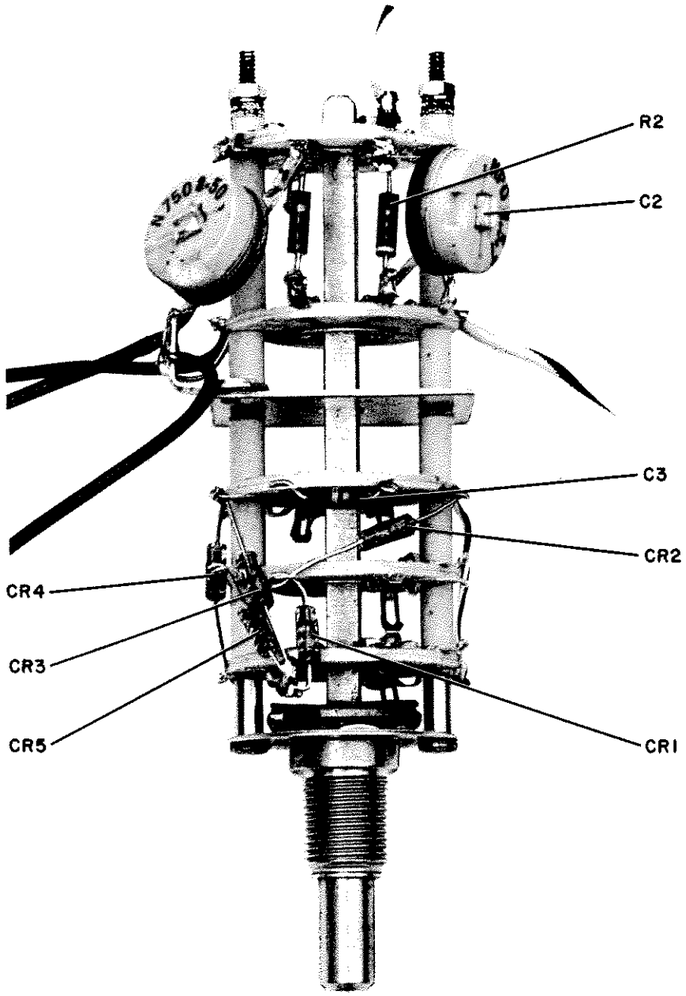
MEASUREMENT UNITS SITUATIONS (NOTES 3,5,6)

FUNCTION SWITCH	TIME BASE SWITCH: 0.1US	1US	10US	0.1mS	1mS	10mS	0.1S	1S	10S	EXT
M START	–	–	–	–	–	–	–	–	–	–
M STOP	–	–	–	–	–	–	–	–	–	–
F	*	MC	MC	MC	KC	KC	KC	KC	KC	X
$1P_A$	US	US	mS	mS	mS	SEC	SEC	SEC	*	–
$10P_A$	US	US	US	mS	mS	mS	SEC	SEC	*	–
$100P_A$	US	US	US	US	mS	mS	mS	*	*	–
1KP_A	US	US	US	US	US	mS	*	*	*	–
10KP_A	US	US	US	US	US	*	*	*	*	–
100KP_A	US	US	US	US	*	*	*	*	*	–
R	–	–	–	–	–	–	–	–	–	–

SOURCE OF DP AND MU CONTROLS (NOTES 5,6)

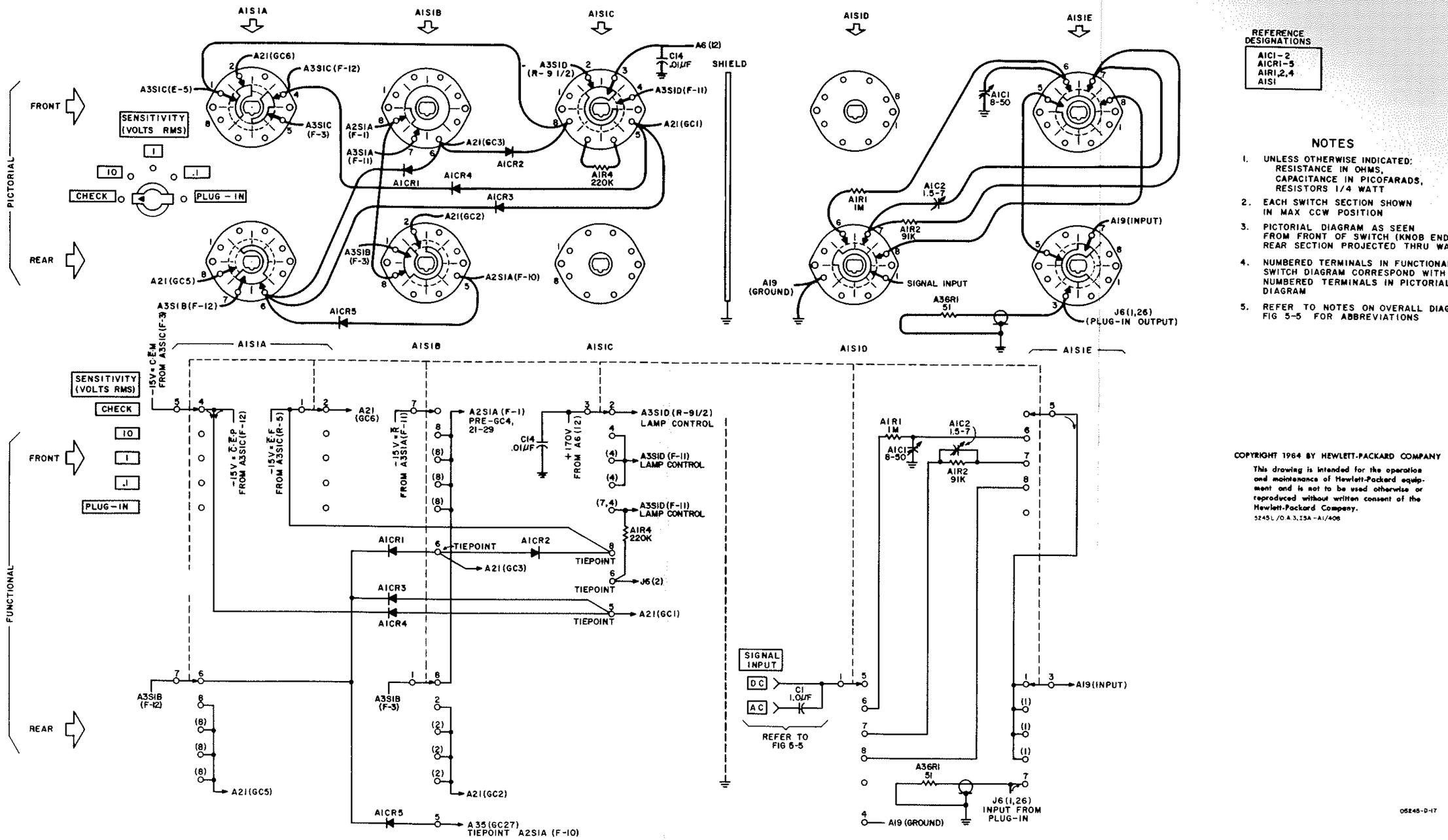
DP DESIGNATION	INTERNAL SOURCE	REMOTE CONTROL (J10 PIN NO)	MU DESIGNATION	INTERNAL SOURCE	REMOTE CONTROL (J10 PIN NO)
7	–	7	MC	A2S1B (R-2 1/2)	13
6	A2S1E (R-5)	6	KC	A2S1H (R-8 1/2)	12
5	A2S1E (R-8)	5	SEC	A2S1F (R-4)	14
4	A2S1E (F-7)	4	mS	A2S1G (R-7)	15
3	A2S1D (R-6)	3	US	A2S1G (R-10)	16
2	A2S1C (F-7)	2	*	A2S1G (R-6)	11
1	A2S1D (F-9)	1			
0	A2S1C (R-8)	10			

Figure 5-5. Overall Functional Diagram



BOTTOM VIEW

Figure 5-6. Input Switch A1, Component Location



REFERENCE DESIGNATIONS

A1C1-2 A1CR1-5 A1R1,2,4 A1S1

NOTES

1. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS, RESISTORS 1/4 WATT
2. EACH SWITCH SECTION SHOWN IN MAX CCW POSITION
3. PICTORIAL DIAGRAM AS SEEN FROM FRONT OF SWITCH (KNOB END); REAR SECTION PROJECTED THRU WAFER
4. NUMBERED TERMINALS IN FUNCTIONAL SWITCH DIAGRAM CORRESPOND WITH NUMBERED TERMINALS IN PICTORIAL DIAGRAM
5. REFER TO NOTES ON OVERALL DIAGRAM FIG 5-5 FOR ABBREVIATIONS

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5245L/0.A.3,1SA-A1/406

05245-0-17

01930-1

Figure 5-7. Input Switch Assembly A1

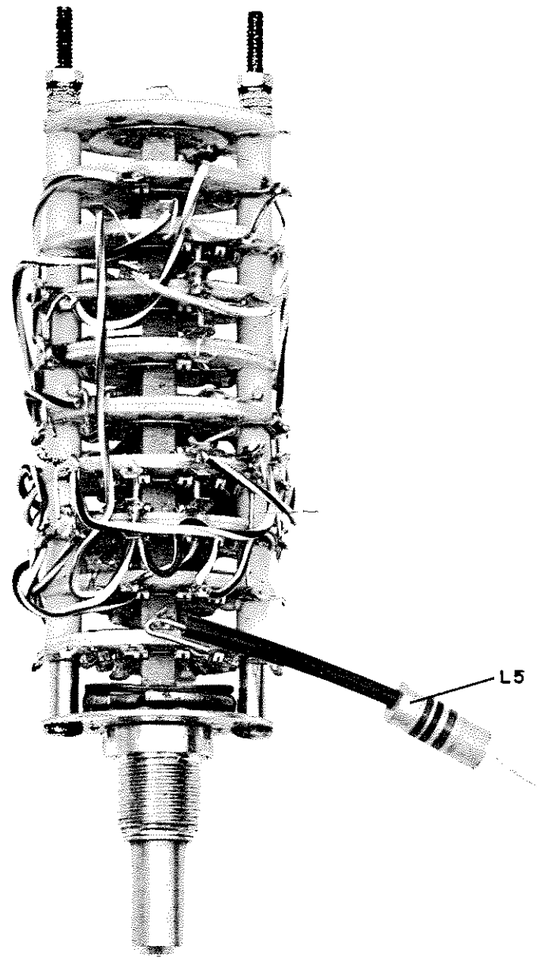
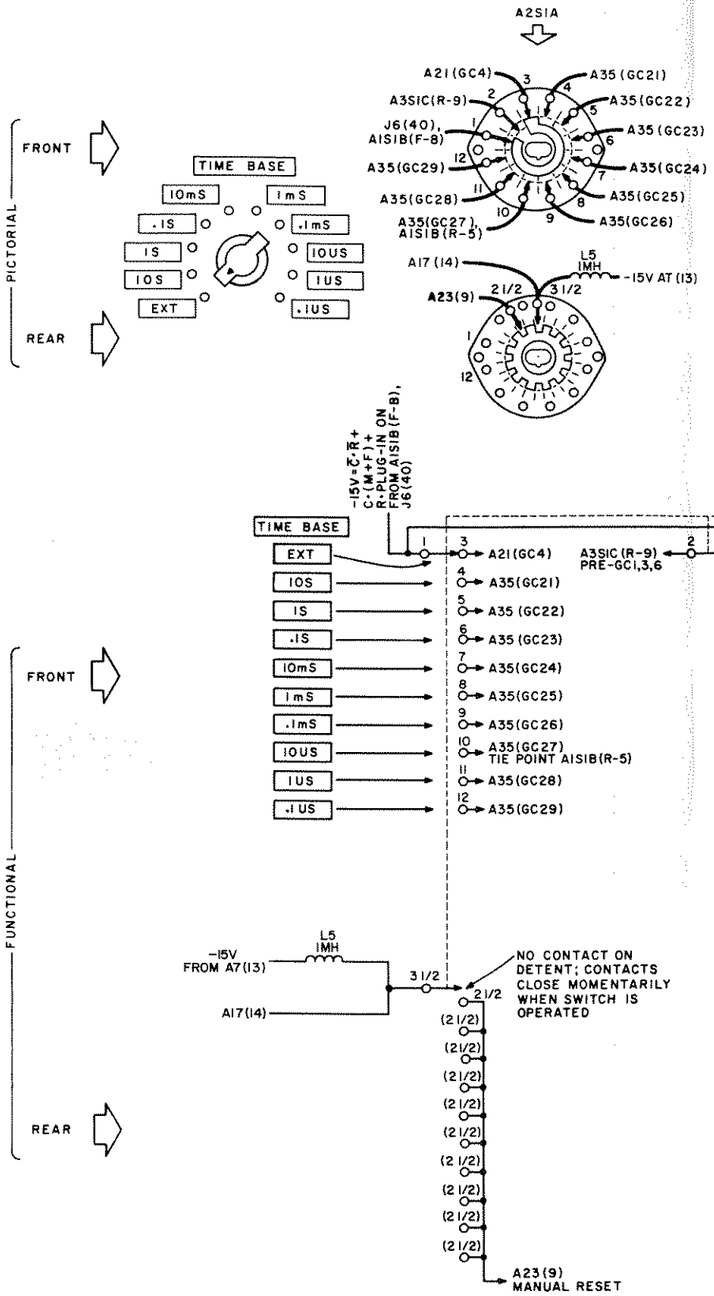
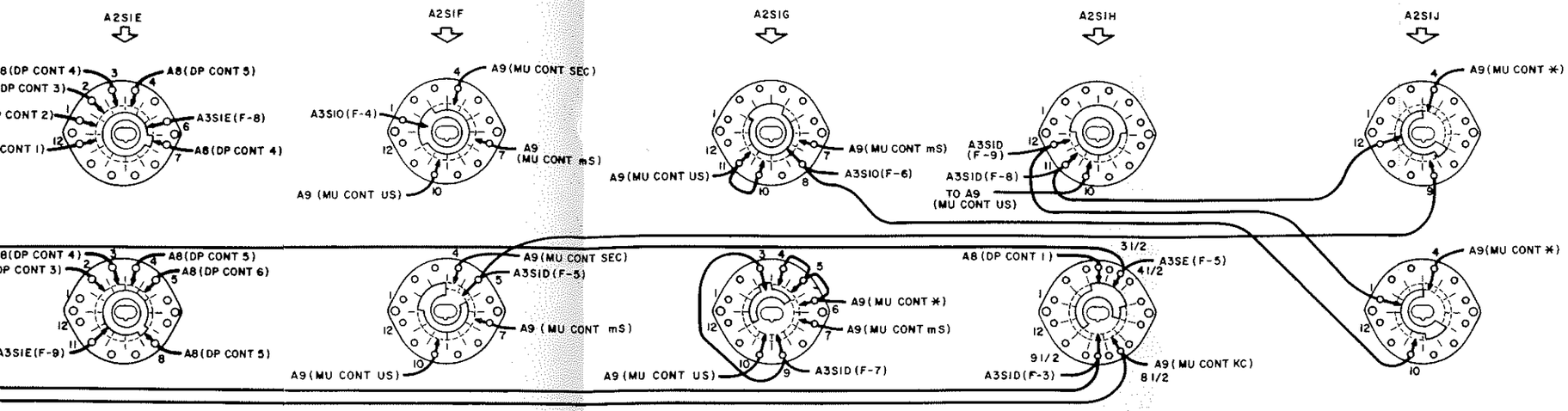


Figure 5-8. Time Base Switch Assembly A2
Component Location


PICTORIAL
FRONT
REAR
TIME BASE
10mS
1mS
.1S
.1mS
1S
10US
10S
1US
EXT
.1US
A2SIA
A21(GC4)
A35(GC21)
A3SIC(R-9)
A35(GC22)
J6(40), A1SIB(F-8)
A35(GC23)
A35(GC29)
A35(GC24)
A35(GC28)
A35(GC25)
A35(GC27), A1SIB(R-5)
A35(GC26)
A17(14)
L5 1MH
-15V AT (13)
A23(9)
2 1/2
3 1/2
A2SIB
A9(MU CONT *)
A8 (DP CONT 4)
A8(DP CONT 3)
A3SIE(F-3)
A6(DP CONT 0)
A8(DP CONT 1)
A8(DP CONT 2)
A2SIC
A8(DP CONT 0)
A3SIE(F-4)
A9(MU CONT *)
A8(DP CONT 0)
A8(DP CONT 1)
A8(DP CONT 2)
A8(DP CONT 0)
A8(DP CONT 1)
A8(DP CONT 2)
A8(DP CONT 0)
A8(DP CONT 1)
A2SID
A3SIE(F-6)
A8 (DP CONT 3)
A8(DP CONT 2)
A8 (DP CONT 2)
A8 (DP CONT 1)
A8 (DP CONT 0)
A8 (DP CONT 2)
A8(DP CONT 0)
A8(DP CONT 1)
A8(DP CONT 2)
A8(DP CONT 4)
A8(DP CONT 3)
A8(DP CONT 2)
A8(DP CONT 1)
A3SIE(F-9)
A9(MU CONT MC)
2 1/2
4 1/2
1
8 1/2
A8(DP CONT 0)
A8(DP CONT 1)
A8(DP CONT 2)
A8(DP CONT 4)
A8(DP CONT 3)
A8(DP CONT 2)
A8(DP CONT 1)
A8(DP CONT 0)
A8(DP CONT 2)
A3SIE(F-7)
-15V=C̄·R+ C·(M+F)+ R·PLUG-IN ON FROM A1SIB(F-8), J6(40)
FUNCTIONAL
FRONT
REAR
TIME BASE
EXT
10S
1S
.1S
10mS
1mS
.1mS
10US
1US
.1US
A21(GC4)
A35(GC21)
A35(GC22)
A35(GC23)
A35(GC24)
A35(GC25)
A35(GC26)
A35(GC27) TIE POINT A1SIB(R-5)
A35(GC28)
A35(GC29)
A3SIC(R-9) PRE-GC1,3,6
-15V FROM A7(13)
L5 1MH
A17(14)
3 1/2
2 1/2
NO CONTACT ON DETENT; CONTACTS CLOSE MOMENTARILY WHEN SWITCH IS OPERATED
A23(9) MANUAL RESET
+17OV=C̄·F̄ FROM A3SIE(F-3)
A9(MU CONT *)
A8(DP CONT 4)
A8(DP CONT 3)
A8(DP CONT 2)
A8(DP CONT 1)
A8(DP CONT 0)
+17OV=C·1P FROM A3SIE(F-4), J6(17)
A8(DP CONT 0)
A9(MU CONT *)
A8(DP CONT 0)
A8(DP CONT 1)
A8(DP CONT 2)
A8(DP CONT 0)
A8(DP CONT 1)
+17OV=C̄·100P FROM A3SIE(F-6)
A8(DP CONT 2)
A8(DP CONT 0)
A8(DP CONT 1)
A8(DP CONT 2)
A8(DP CONT 0)
A8(DP CONT 1)
A8(DP CONT 2)
A8(DP CONT 3)
+17OV=C̄·10KP FROM A3SIE(F-8)
4 1/2
8 1/2
2 1/2
A9(MU CONT MC)
A8(DP CONT 1)
A8(DP CONT 2)
A8(DP CONT 0)
+17OV=C̄·1KP FROM A3SIE(F-7)
A8(DP CONT 3)
A8(DP CONT 2)
A8(DP CONT 0)
A8(DP CONT 1)
A8(DP CONT 2)
A8(DP CONT 3)
A8(DP CONT 4)
+17OV=C̄·100KP FROM A3SIE(F-9)



NOTES

1. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS,
   CAPACITANCE IN PICOFARADS
   RESISTORS 1/4 WATT.
2. EACH SWITCH SECTION SHOWN IN MAX CCW POSITION
3. PICTORIAL DIAGRAM AS SEEN FROM FRONT OF SWITCH (KNOB END); REAR SECTION PROJECTED THRU WAFER
4. NUMBERED TERMINALS IN FUNCTIONAL SWITCH DIAGRAM CORRESPOND WITH NUMBERED TERMINALS IN PICTORIAL DIAGRAM
5. REFER TO NOTES ON OVERALL DIAGRAM FIG. 5-5 FOR ABBREVIATIONS
6. **WAVEFORMS SHOWN WERE OBTAINED WITH FUNCTION SWITCH AT MANUAL START, SENSITIVITY SWITCH AT CHECK. OUTPUT SWITCH WAS ROTATED FROM 100 CPS POSITION TO 10 MC POSITION.**

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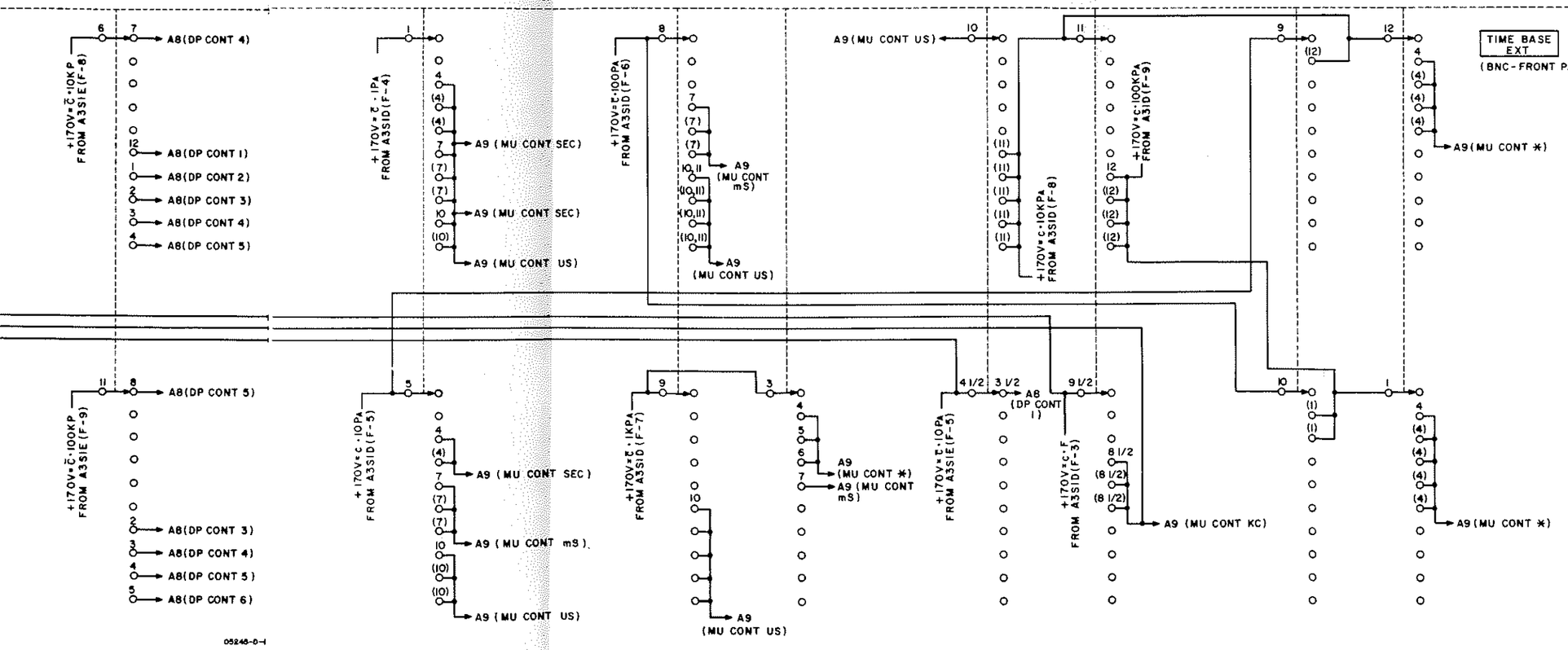
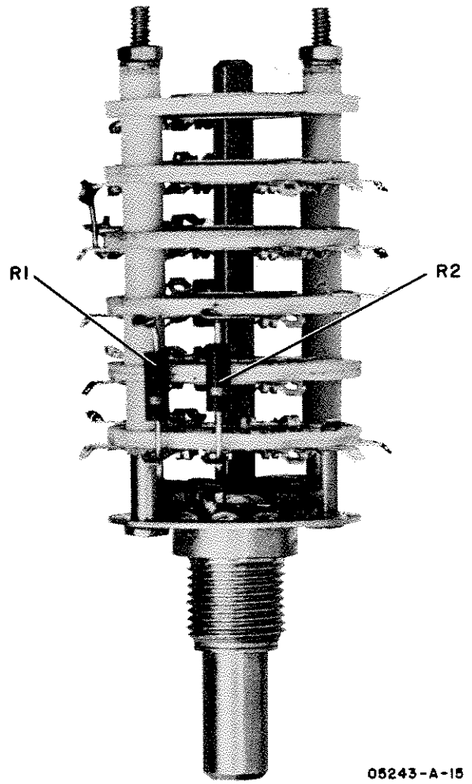
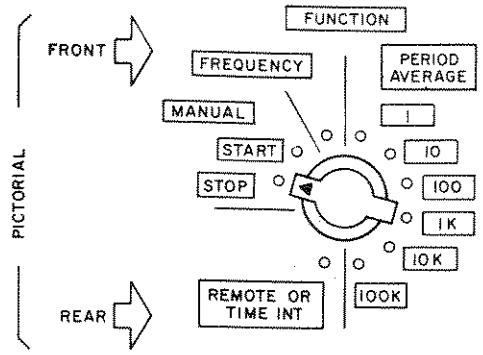


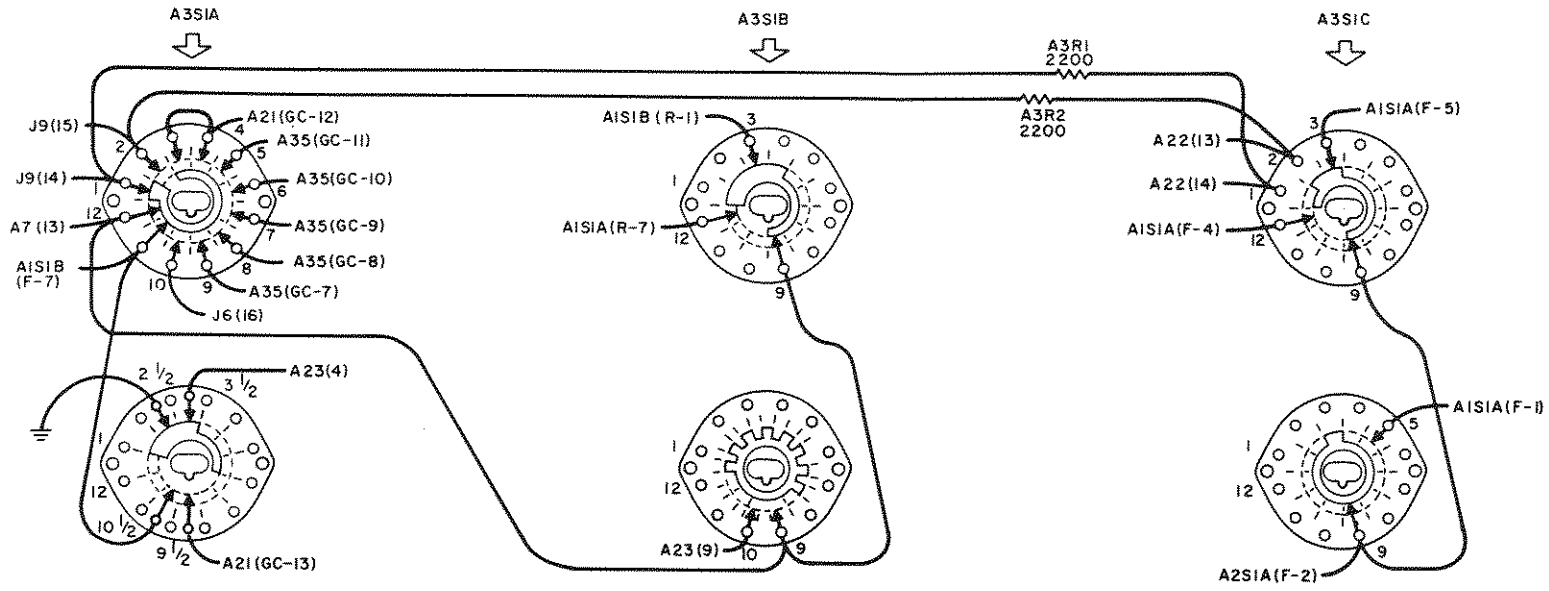
Figure 5-9. Time Base Switch Assembly A2

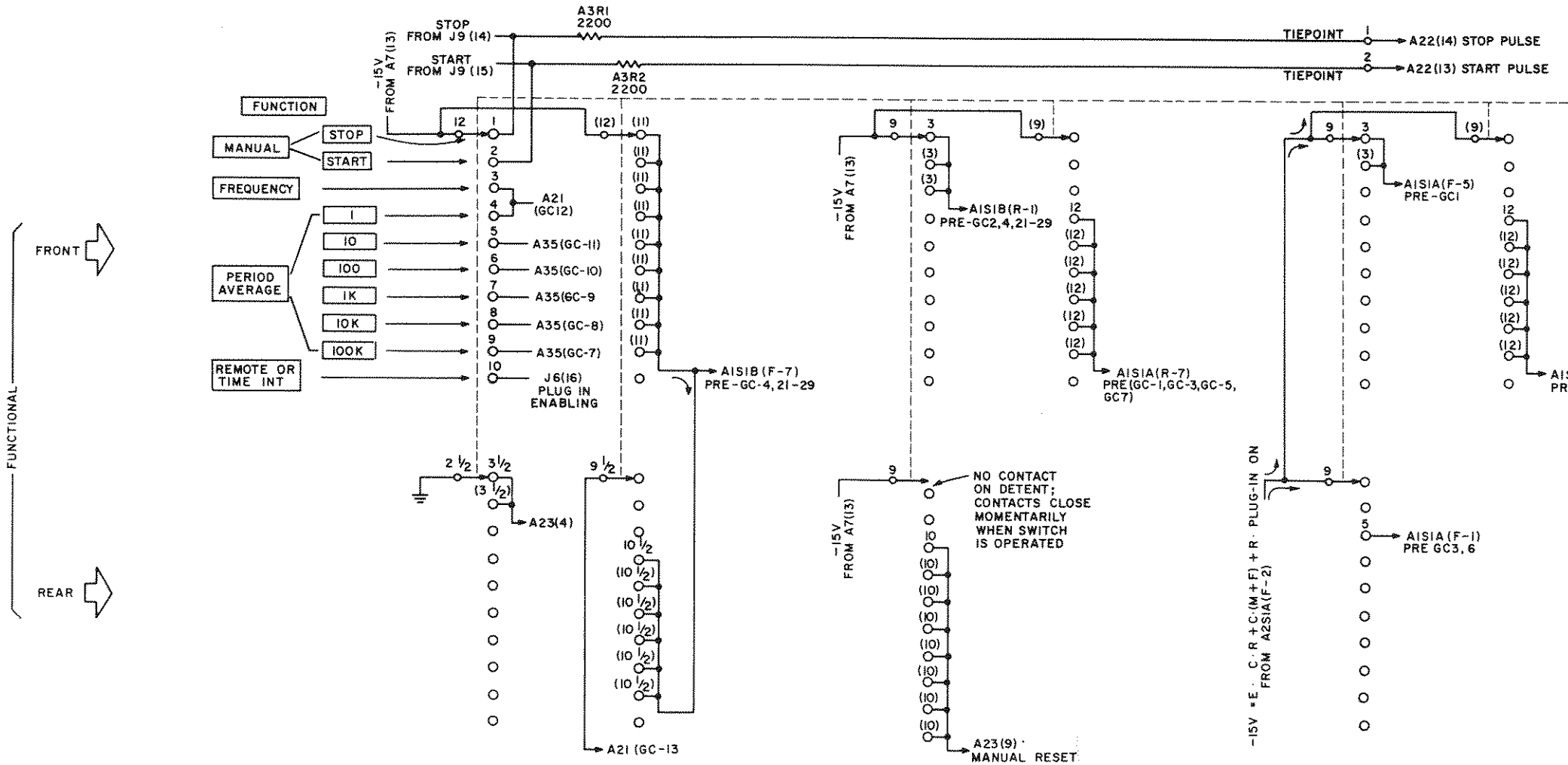


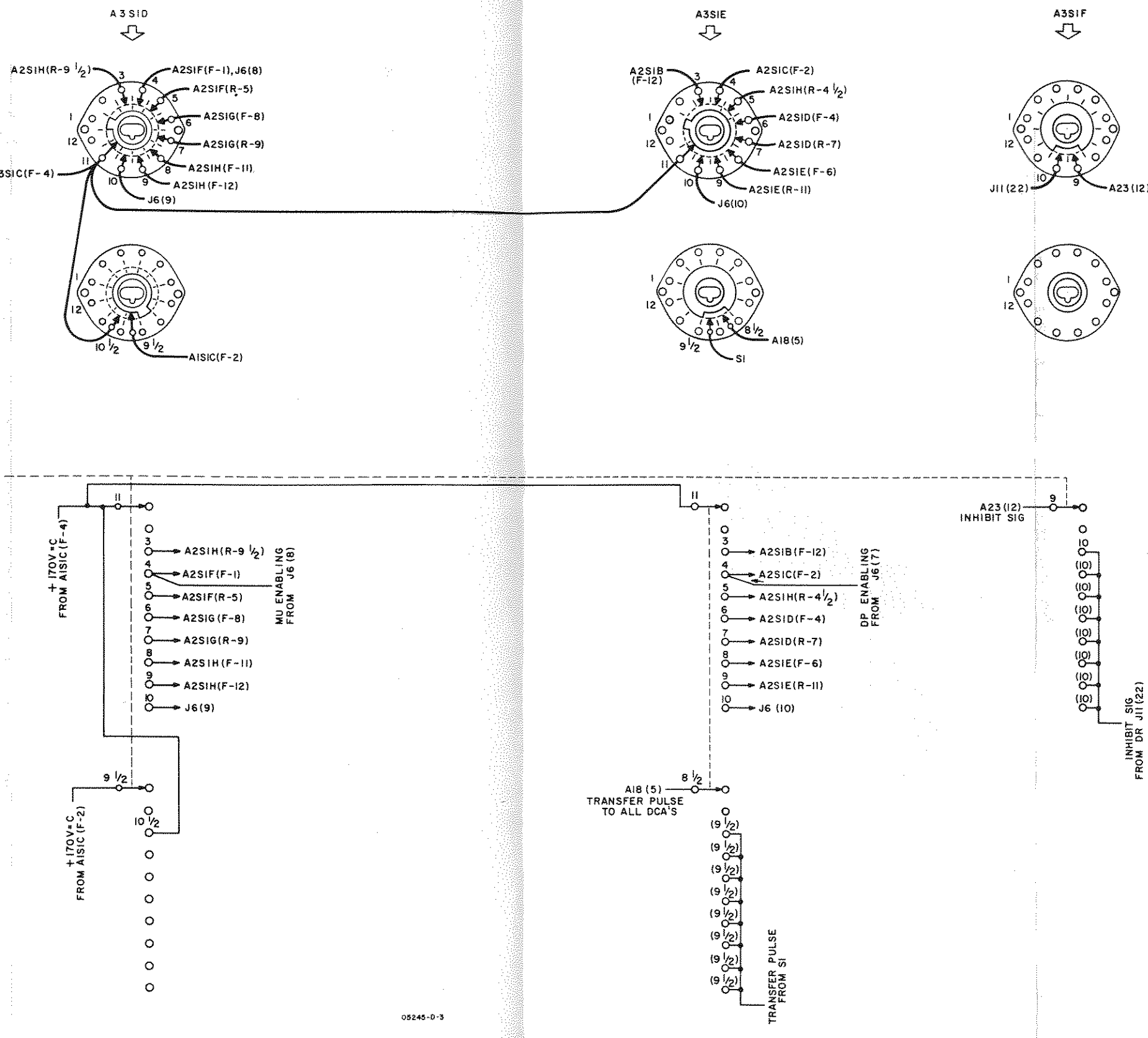
BOTTOM VIEW

Figure 5-10. Function Switch Assembly A3, Component Location


PICTORIAL
FRONT
REAR
FUNCTION
FREQUENCY
PERIOD AVERAGE
MANUAL
START
STOP
REMOTE OR TIME INT
1
10
100
1K
10K
100K


A3S1A
A3S1B
A3S1C
A3R1 2200
A3R2 2200
J9(15)
J9(14)
A7(13)
A1S1B (F-7)
A21(GC-12)
A35(GC-11)
A35(GC-10)
A35(GC-9)
A35(GC-8)
A35(GC-7)
J6(16)
A23(4)
A21(GC-13)
A1S1B (R-1)
A1S1A(R-7)
A23(9)
A22(13)
A22(14)
A1S1A(F-4)
A1S1A(F-5)
A1S1A(F-1)
A2S1A(F-2)
A2S1H(R-9 1/2)
A3S1C(F-4)


FUNCTIONAL
FRONT
REAR
STOP FROM J9 (14)
START FROM J9 (15)
-15V FROM A7(13)
A3R1 2200
A3R2 2200
TIEPOINT
A22(14) STOP PULSE
A22(13) START PULSE
FUNCTION
MANUAL
STOP
START
FREQUENCY
PERIOD AVERAGE
1
10
100
1K
10K
100K
REMOTE OR TIME INT
A21 (GC12)
A35(GC-11)
A35(GC-10)
A35(GC-9
A35(GC-8)
A35(GC-7)
J6(16) PLUG IN ENABLING
A1S1B (F-7) PRE-GC-4, 21-29
A23(4)
A21 (GC-13
A1S1B(R-1) PRE-GC2,4,21-29
A1S1A(R-7) PRE(GC-1,GC-3,GC-5, GC7)
NO CONTACT ON DETENT; CONTACTS CLOSE MOMENTARILY WHEN SWITCH IS OPERATED
A23(9) · MANUAL RESET
A1S1A(F-5) PRE-GC1
A1S1A(F-4) PRE-GC1
A1S1A(F-1) PRE GC3, 6
-15V = E . C . R + C . (M + F) + R . PLUG-IN ON FROM A2S1A(F-2)
+170V=C FROM A1S1C(F-4)
+170V=C FROM A1S1C(F-2)



NOTES

1. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS, RESISTORS 1/4 WATT.
2. EACH SWITCH SECTION SHOWN IN MAX CCW POSITION
3. PICTORIAL DIAGRAM AS SEEN FROM FRONT OF SWITCH (KNOB END); REAR SECTION PROJECTED THRU WAFER
4. NUMBERED TERMINALS IN FUNCTIONAL SWITCH DIAGRAM CORRESPOND WITH NUMBERED TERMINALS IN PICTORIAL DIAGRAM
5. REFER TO NOTES ON FIG. 5-5 (OVERALL DIAGRAM) FOR ABBREVIATIONS

REFERENCE DESIGNATIONS

A3R1-2
A3S1

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Figure 5-11. Function Switch Assembly A3

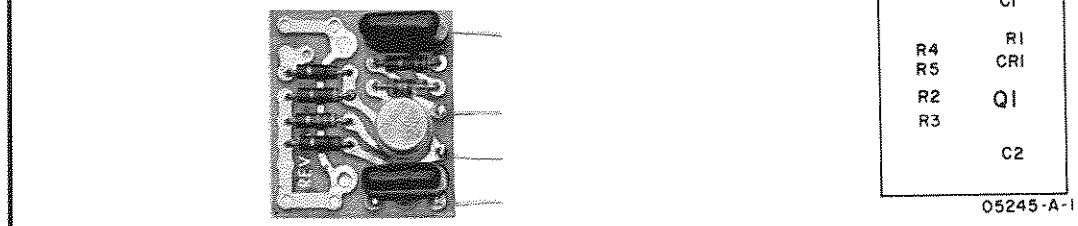
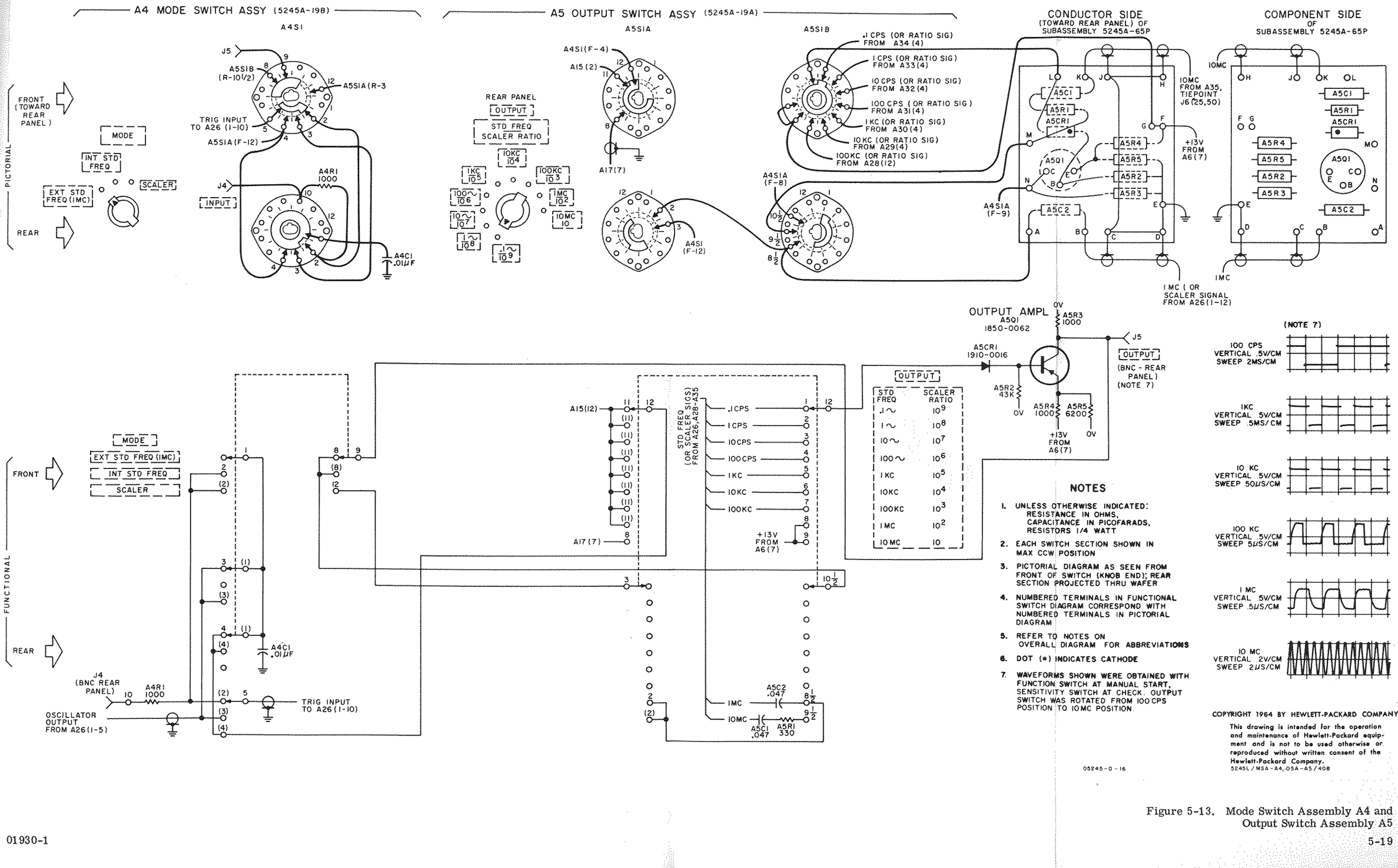


Figure 5-12. Output Switch Subassembly, Component Location



(NOTE 7)

NOTES

1. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS, RESISTORS 1/4 WATT
2. EACH SWITCH SECTION SHOWN IN MAX CCW POSITION
3. PICTORIAL DIAGRAM AS SEEN FROM FRONT OF SWITCH (KNOB END); REAR SECTION PROJECTED THRU WAFER
4. NUMBERED TERMINALS IN FUNCTIONAL SWITCH DIAGRAM CORRESPOND WITH NUMBERED TERMINALS IN PICTORIAL DIAGRAM
5. REFER TO NOTES ON OVERALL DIAGRAM FOR ABBREVIATIONS
6. DOT (•) INDICATES CATHODE
7. WAVEFORMS SHOWN WERE OBTAINED WITH FUNCTION SWITCH AT MANUAL START, SENSITIVITY SWITCH AT CHECK. OUTPUT SWITCH WAS ROTATED FROM 100 CPS POSITION TO 10MC POSITION

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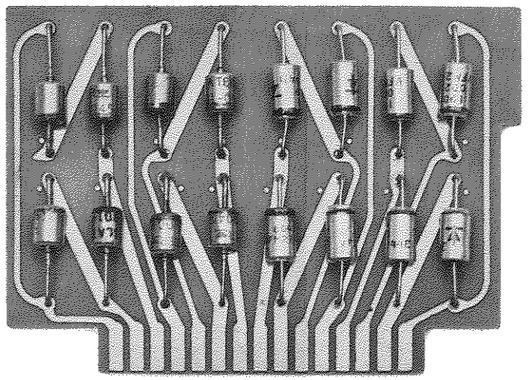
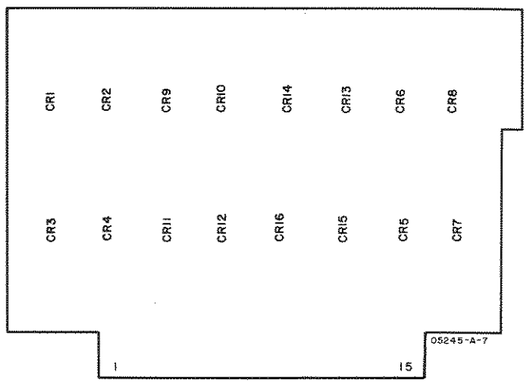
05245-D-16

01930-1

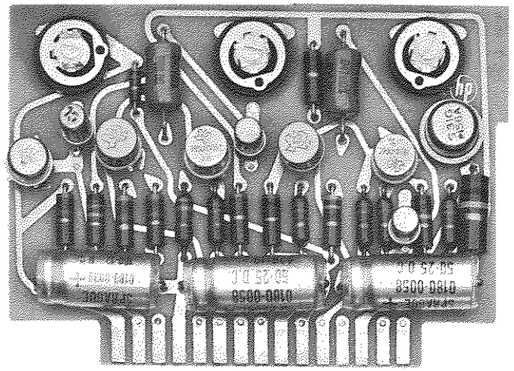
Figure 5-13. Mode Switch Assembly A4 and Output Switch Assembly A5

A6





A7



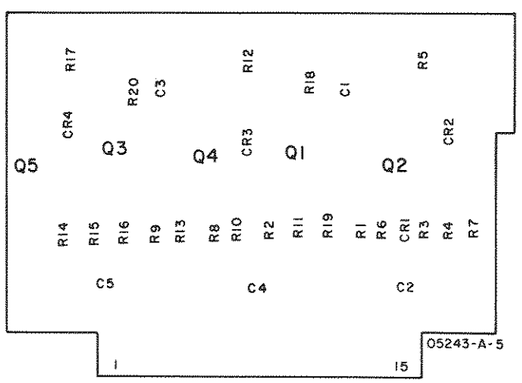
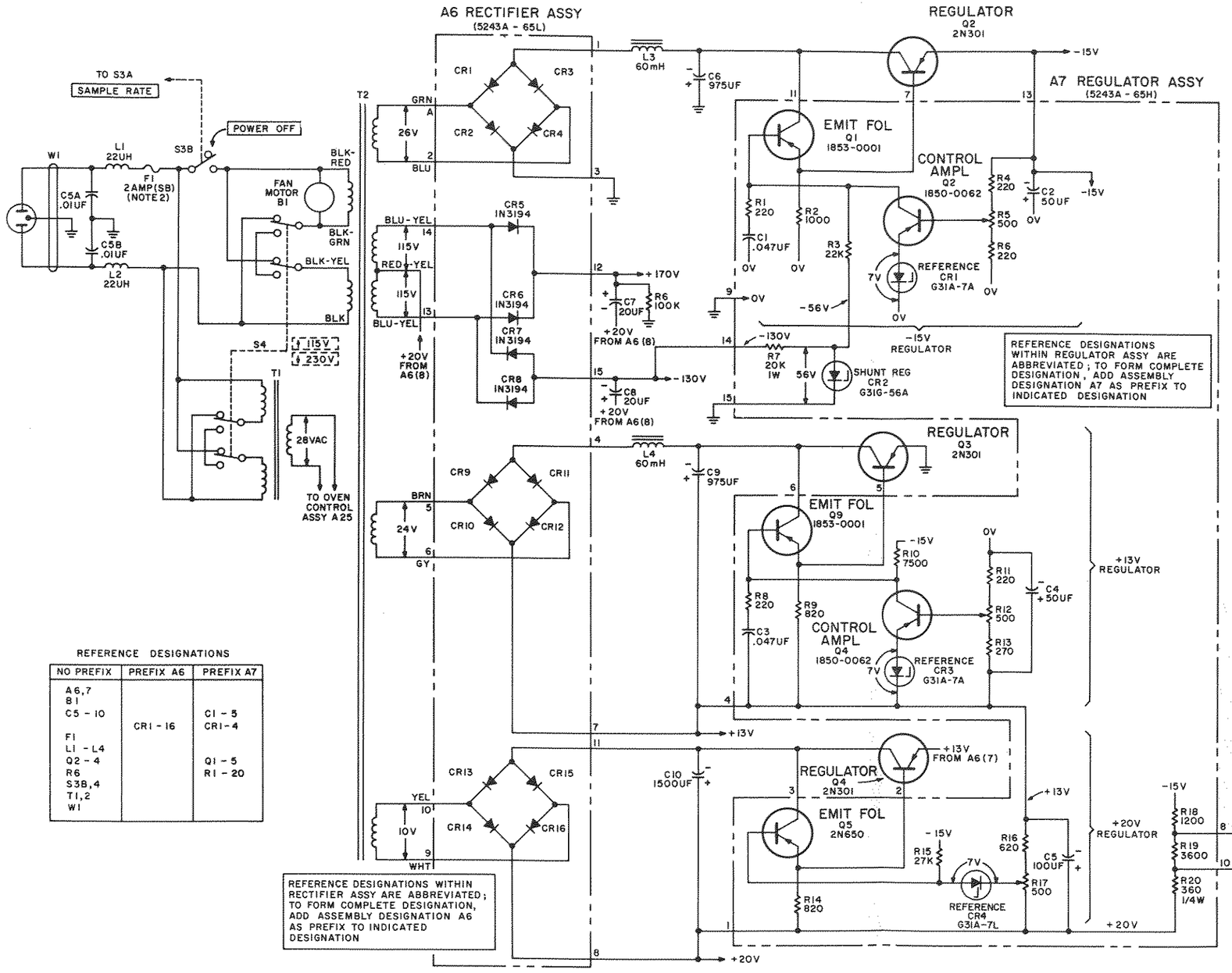


Figure 5-14. Rectifier Assembly A6 and Regulator Assembly A7 Component Location



REFERENCE DESIGNATIONS

NO PREFIX	PREFIX A6	PREFIX A7
A6,7 B1 C5 - 10 F1 L1 - L4 Q2 - 4 R6 S3B,4 T1,2 W1	CR1 - 16	C1 - 5 CR1 - 4 Q1 - 5 R1 - 20

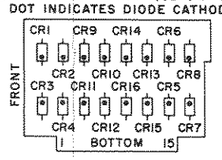
POWER DISTRIBUTION

ASSY	-15V	+13V	+20V	+170V	-130V	0V	ASSY	-15V	+13V	+20V	+170V	-130V	0V
A1				✓		✓	A19	✓	✓	✓	✓		✓
A2	✓					✓	A20	✓	✓	✓			✓
A3	✓						A21		✓	✓			✓
A4							A22	✓	✓				✓
A5	✓					✓	A23	✓	✓	✓			✓
A6	RECTIFIER ASSY					✓	A24						✓
A7	REGULATOR ASSY					✓	A25	(32 VAC)					✓
A8	✓		✓				A26	✓		✓			✓
A9	✓		✓				A27	✓					✓
A10	✓		✓	✓	✓		A28	✓	✓				
A11	✓		✓	✓	✓		A29	✓	✓				
A12	✓		✓	✓	✓		A30	✓	✓				
A13	✓		✓	✓	✓		A31	✓	✓				
A14	✓		✓	✓	✓		A32	✓	✓				
A15	✓		✓	✓	✓		A33	✓	✓				
A16	✓		✓	✓	✓		A34	✓	✓				
A17		✓	✓			✓	A35	✓	✓	✓			✓
A18	✓		✓	✓	✓		J6	✓	✓	✓	✓	✓	✓
							J9	✓	✓	✓			✓
							J10				✓	✓	

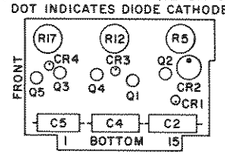
NOTES

1. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS
   CAPACITANCE IN PICOFARADS
   RESISTORS 1/2 WATT
2. FOR 230V OPERATION, OPERATE S4 TO 230V POSITION AND INSTALL 1AMP SLOW-BLOW FUSE (F1)

COMPONENT LOCATION (5243A - 65L)
DOT INDICATES DIODE CATHODE



COMPONENT LOCATION (5243A-65H)
DOT INDICATES DIODE CATHODE



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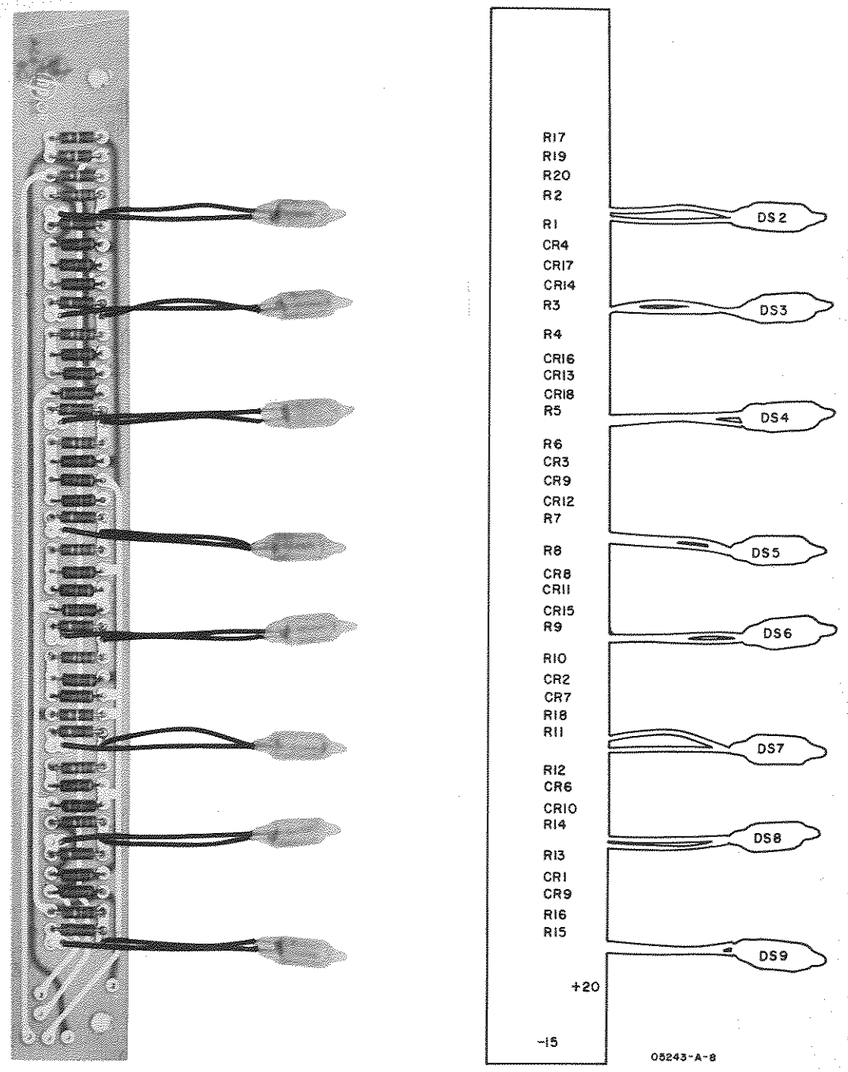
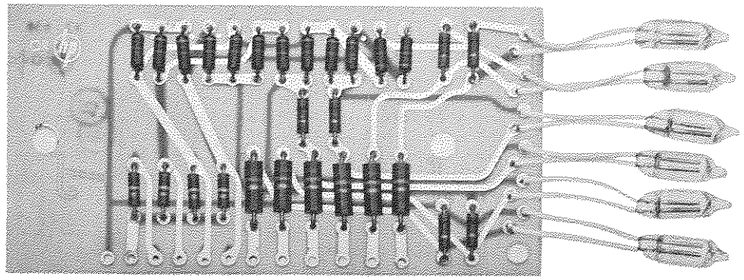
05245-D-18

Figure 5-15. Power Supply, Rectifier Assembly A6, and Regulator Assembly A7

A8



A9



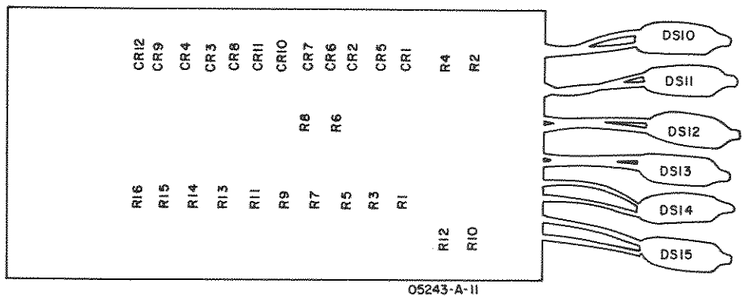
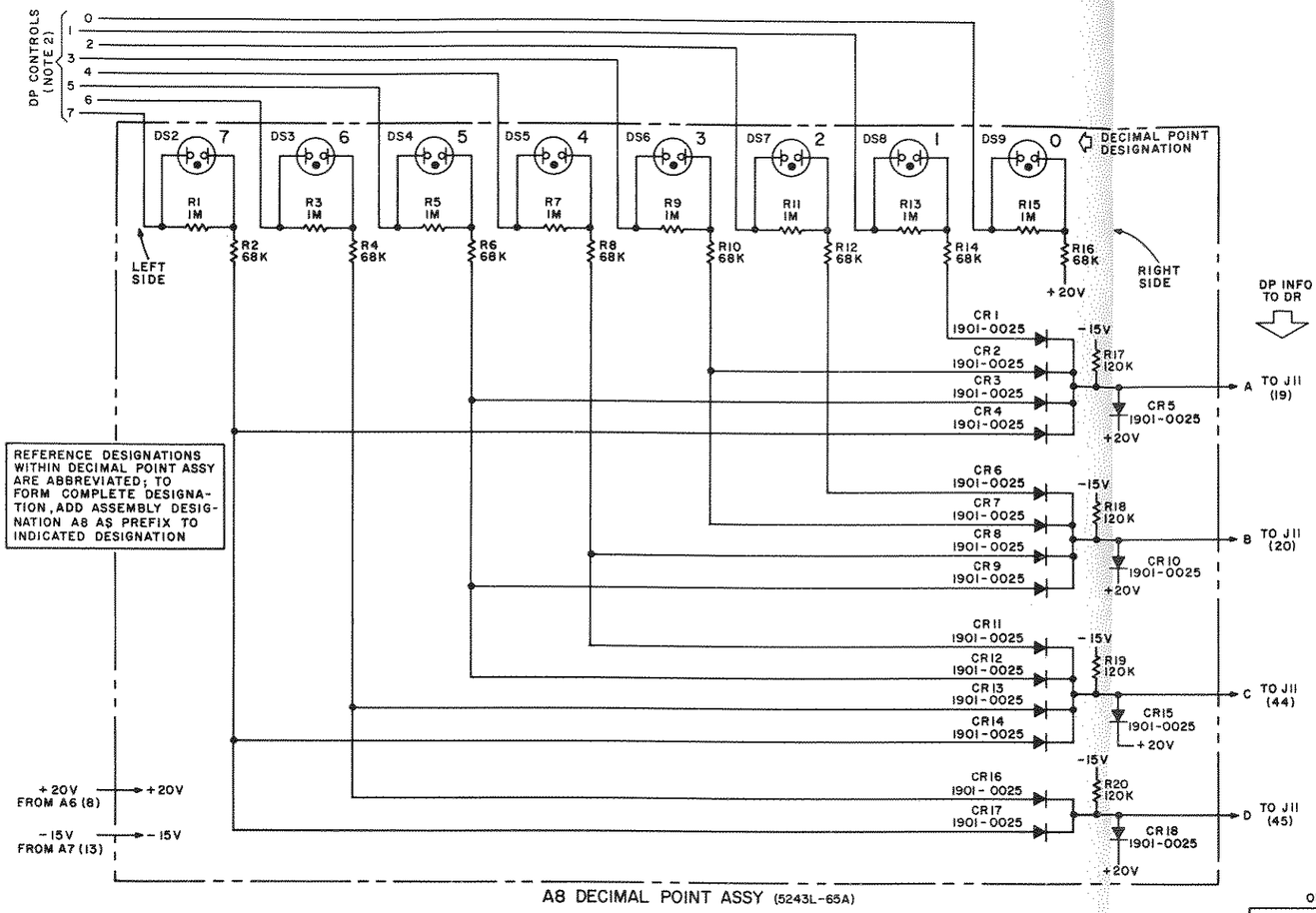
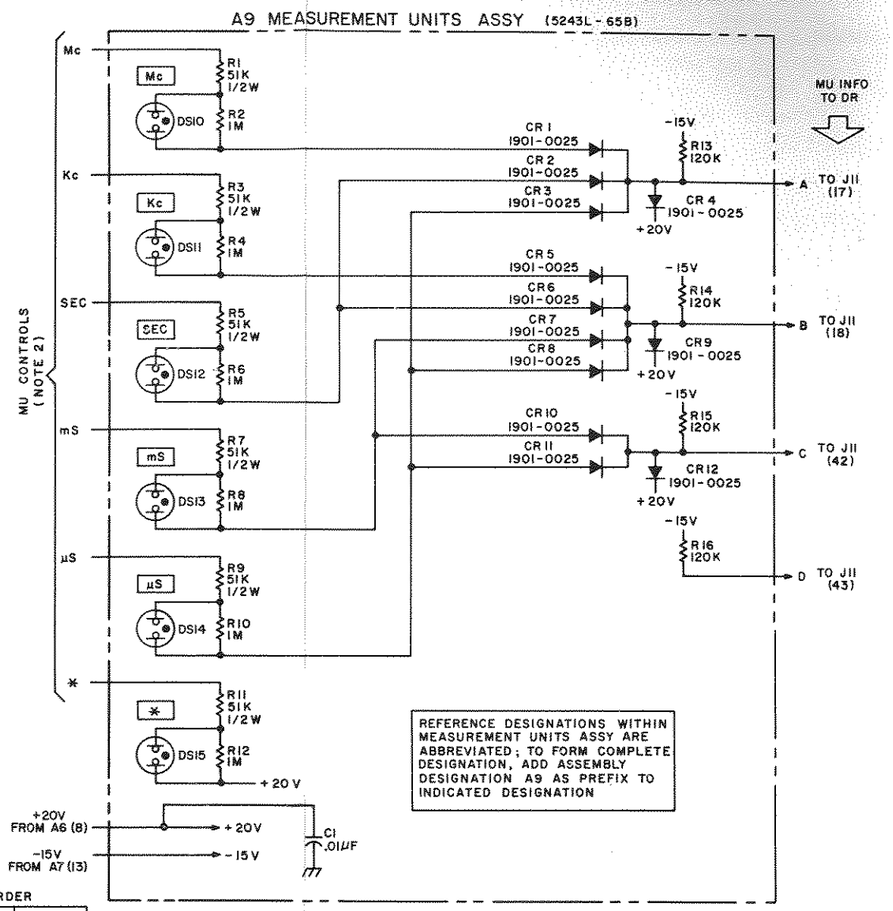


Figure 5-16. Decimal Point Assembly A8 and Measurement Units Assembly A9 Component Location





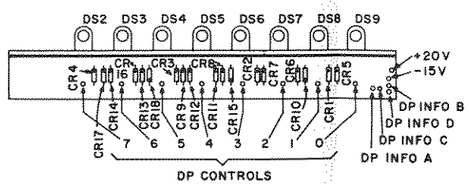
NOTES

1. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS
   CAPACITANCE IN PICOFARADS
   RESISTORS 1/4 WATT
2. INPUT OF +17OV FOP DP CONTROLS AND MU CONTROLS IS REQUIRED TO TURN LAMPS ON; SEE TABLE ON OVERALL DIAGRAM SHEET 1 FOR COMPLETE DESCRIPTION

REFERENCE DESIGNATIONS

PREFIX A8	PREFIX A9
CR1-18 DS2-9 R1-20	C1 CR1-12 DS10-15 R1-16

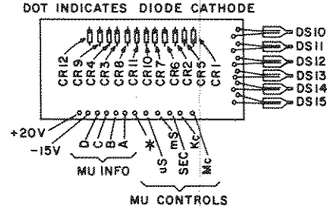
COMPONENT LOCATION (5243L-65A), FROM FRONT
DOT INDICATES DIODE CATHODE


DS2 DS3 DS4 DS5 DS6 DS7 DS8 DS9
CR4 CR16 CR3 CR8 CR2 CR7 CR6 CR5 CR1 CR3
CR17 CR14 CR13 CR18 CR9 CR12 CR11 CR15 CR10 CR1
7 6 5 4 3 2 1 0
+20V
-15V
DP INFO B
DP INFO D
DP INFO C
DP INFO A
DP CONTROLS

OUTPUT TO RECORDER

LIGHTED SYMBOL		4 LINE CODE (0 = −, 1 = +) D	C	B	A	PRINTED DIGIT
DP	NONE	0	0	0	0	0
	0	0	0	0	0	0
	1	0	0	0	1	1
	2	0	0	1	0	2
	3	0	0	1	1	3
	4	0	1	0	0	4
	5	0	1	0	1	5
	6	0	1	1	0	6
	7	0	1	1	1	7
MU	Mc	0	0	0	1	1
	Kc	0	0	1	0	2
	SEC	0	0	1	1	3
	mS	0	1	0	0	4
	uS	0	1	0	1	5
	*	0	0	0	0	0

COMPONENT LOCATION (5243L-65B), FROM LEFT
DOT INDICATES DIODE CATHODE



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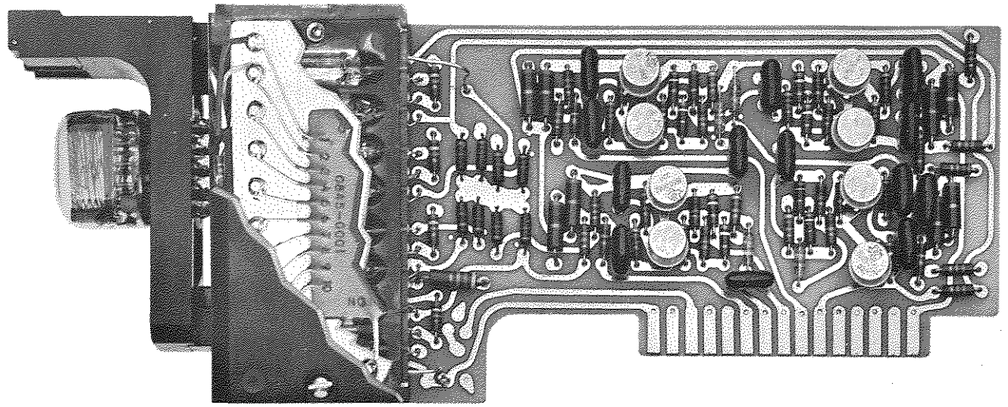
05245-0-22

Figure 5-17. Decimal Point Assembly A8 and Measurement Units Assembly A9



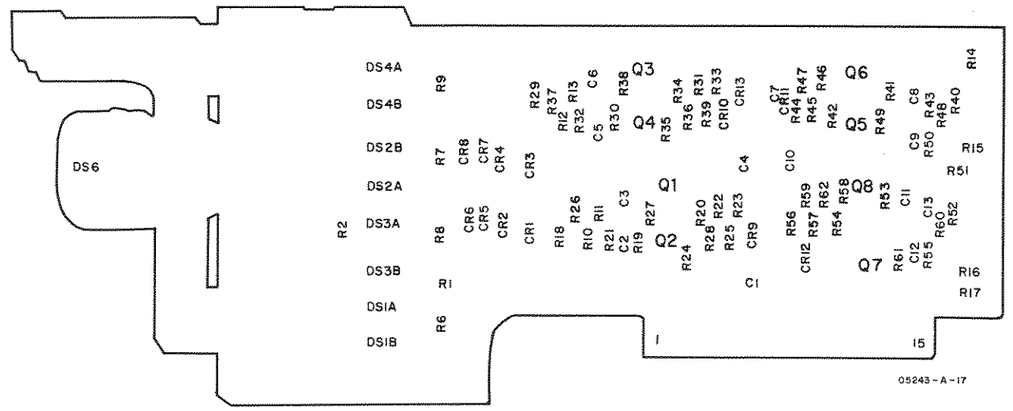
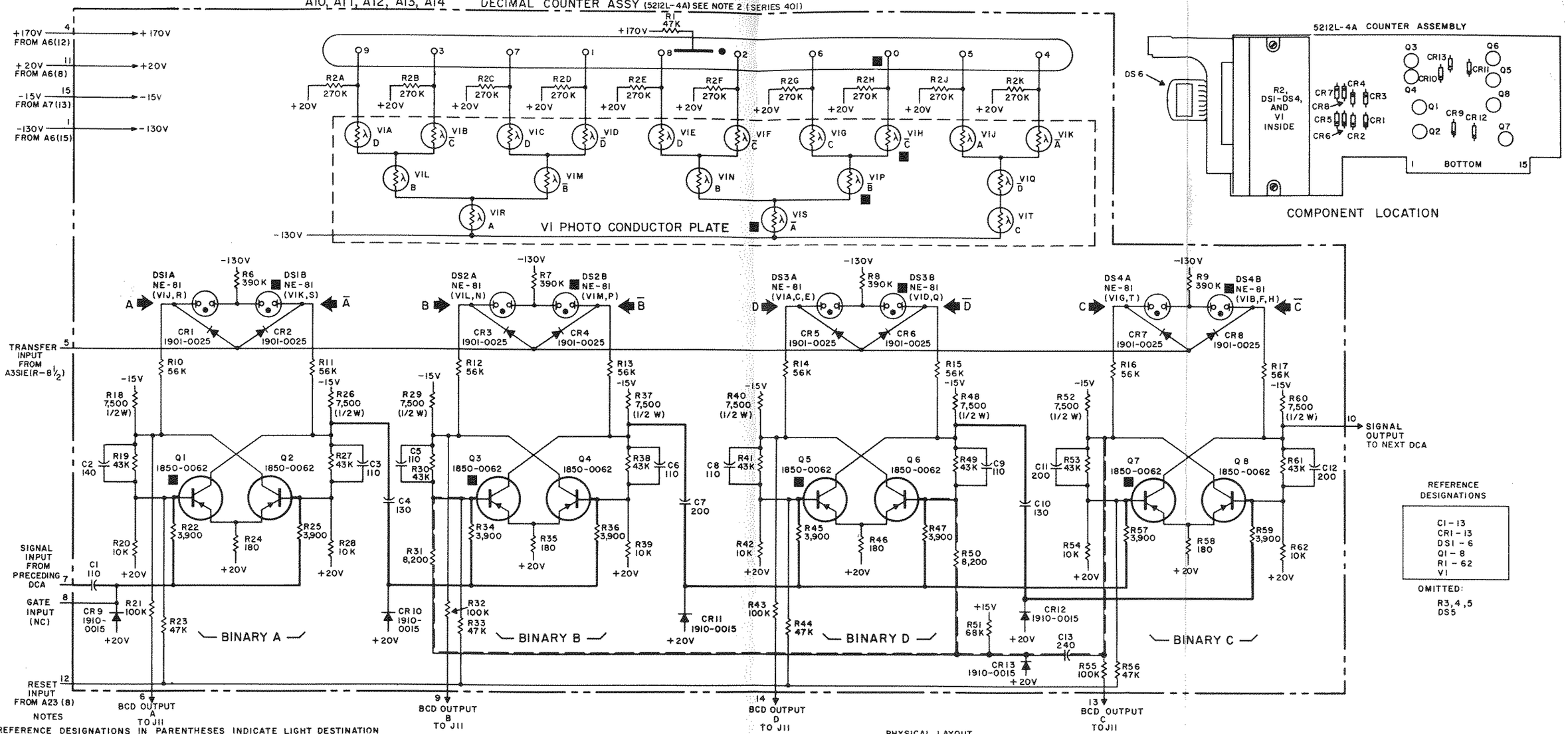


Figure 5-18. Decimal Counter Assembly A10-A14, Component Location



NOTES

1. REFERENCE DESIGNATIONS IN PARENTHESES INDICATE LIGHT DESTINATION FOR DS1-DS4; LIGHT SOURCE IS NOTED NEAR EACH VI SECTION.
2. REFERENCE DESIGNATIONS WITHIN DECIMAL COUNTER ASSY ARE INCOMPLETE; TO FORM COMPLETE REFERENCE DESIGNATION, ADD ASSY DESIGNATION A10, A11, A12, A13, OR A14, AS PREFIX TO INDICATED DESIGNATION; ASSY DESIGNATION IS SHOWN ON OVERALL FUNCTIONAL SCHEMATIC
3. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS
   RESISTORS 1/4 WATT
4. FOR DS1-DS4, SECTION A LIGHTS ON "1", SECTION B LIGHTS ON "0."
5. FILLED SQUARE (■) INDICATES CONDUCTING ELEMENT FOR DECIMAL "0" (BCD "0000")

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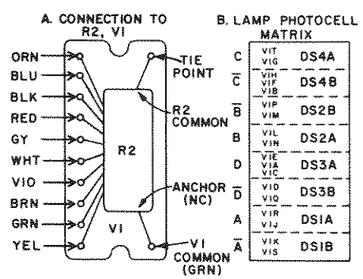
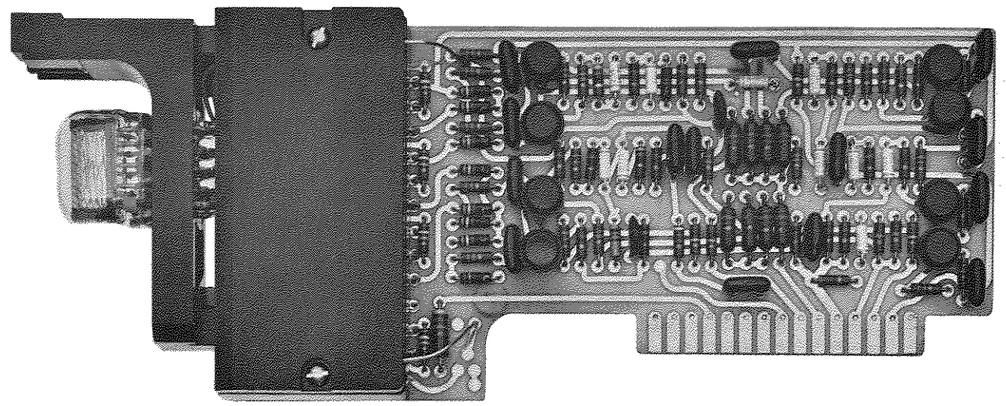
PHYSICAL LAYOUT



DIGIT	4 LINE CODE (0=−, 1=+)				RELEVANT STAGES				
					VI	BINARY			
	D	C	B	A		D	C	B	A
0	0	0	0	0	HPS		■	■	■
1	0	0	0	1	DMR	■		■	■
2	0	0	1	0	FNS		■	■	■
3	0	0	1	1	BLR		■	■	■
4	0	1	1	0	KQT	■	■		■
5	0	1	1	1	JQT	■	■		■
6	1	1	0	0	GPS		■	■	■
7	1	1	0	1	CMR	■	■		■
8	1	1	1	0	ENS	■	■	■	
9	1	1	1	1	ALR	■	■	■	■

05245-D-15

Figure 5-19. Decimal Counter Assembly A10-A14



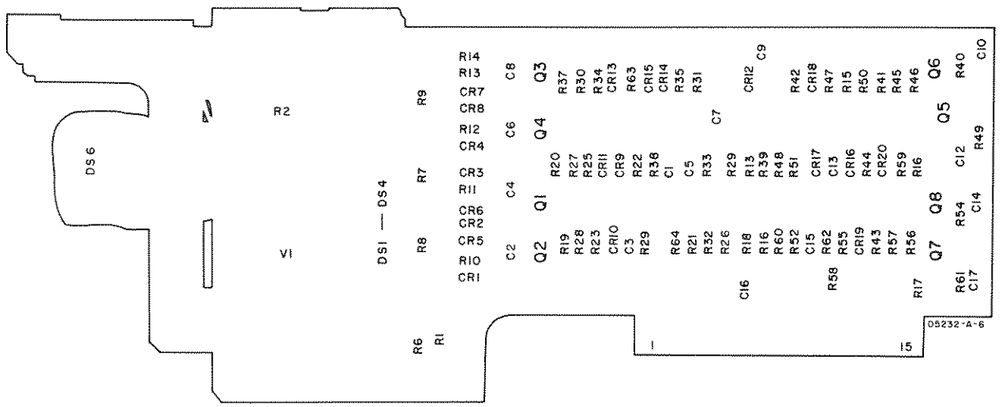
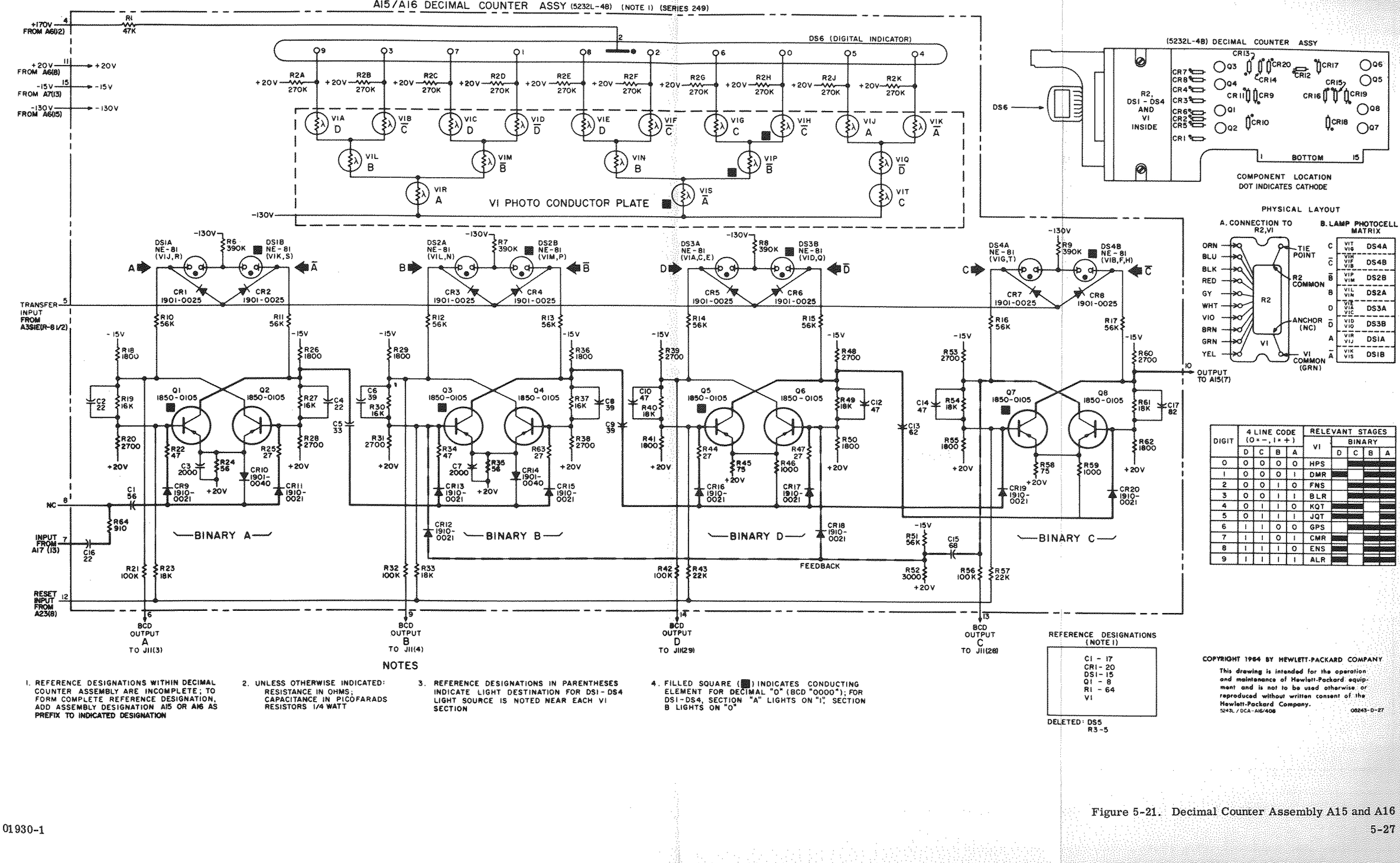


Figure 5-20. Decimal Counter Assembly A15 and A16, Component Location



DIGIT	4 LINE CODE (0 = −, 1 = +)				RELEVANT STAGES				
	D	C	B	A	VI	BINARY D	BINARY C	BINARY B	BINARY A
0	0	0	0	0	HPS	■	■	■	■
1	0	0	0	1	DMR	■		■	■
2	0	0	1	0	FNS	■	■		■
3	0	0	1	1	BLR	■			■
4	0	1	1	0	KQT	■	■	■	
5	0	1	1	1	JQT	■		■	
6	1	1	0	0	GPS		■	■	■
7	1	1	0	1	CMR	■			
8	1	1	1	0	ENS		■		■
9	1	1	1	1	ALR	■			

NOTES

1. REFERENCE DESIGNATIONS WITHIN DECIMAL COUNTER ASSEMBLY ARE INCOMPLETE; TO FORM COMPLETE REFERENCE DESIGNATION, ADD ASSEMBLY DESIGNATION A15 OR A16 AS PREFIX TO INDICATED DESIGNATION
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS RESISTORS 1/4 WATT
3. REFERENCE DESIGNATIONS IN PARENTHESES INDICATE LIGHT DESTINATION FOR DS1 - DS4 LIGHT SOURCE IS NOTED NEAR EACH VI SECTION
4. FILLED SQUARE (■) INDICATES CONDUCTING ELEMENT FOR DECIMAL "0" (BCD "0000"); FOR DS1-DS4, SECTION "A" LIGHTS ON "1"; SECTION B LIGHTS ON "0"

REFERENCE DESIGNATIONS (NOTE 1)

C1 - 17
CR1 - 20
DS1 - 15
Q1 - 8
R1 - 64
VI

DELETED: DS5
R3-5

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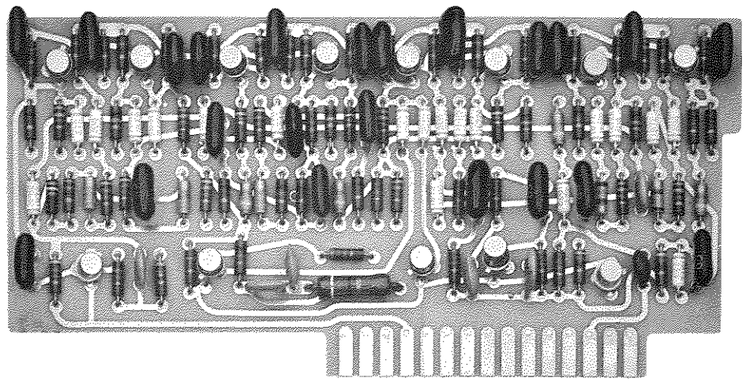
5245L/DCA-A15/A16
05243-D-27

Figure 5-21. Decimal Counter Assembly A15 and A16



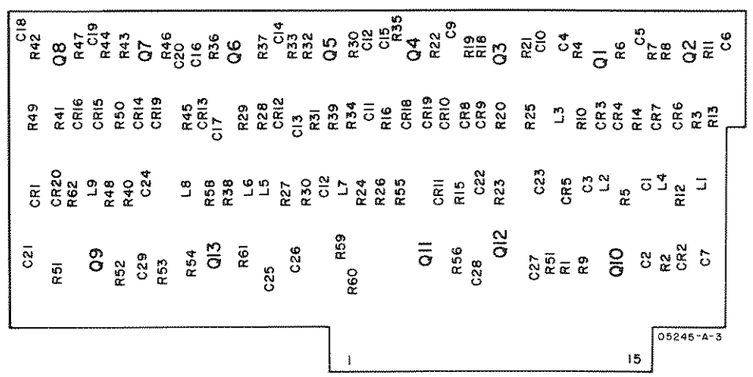


Figure 5-22. Decimal Counter Assembly A17, Component Location

NOTES

1. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS
   CAPACITANCE IN PICOFARADS
   INDUCTANCE IN MICROHENRIES
   RESISTORS 1/4 WATT
2. FILLED SQUARE (■) INDICATES CONDUCTING TRANSISTOR FOLLOWING RESET (BCD=0000)

REFERENCE DESIGNATIONS

NO PREFIX	PREFIX A17
C13,15	C1-29 CR1-20 L1-9 Q1-13 R1-62

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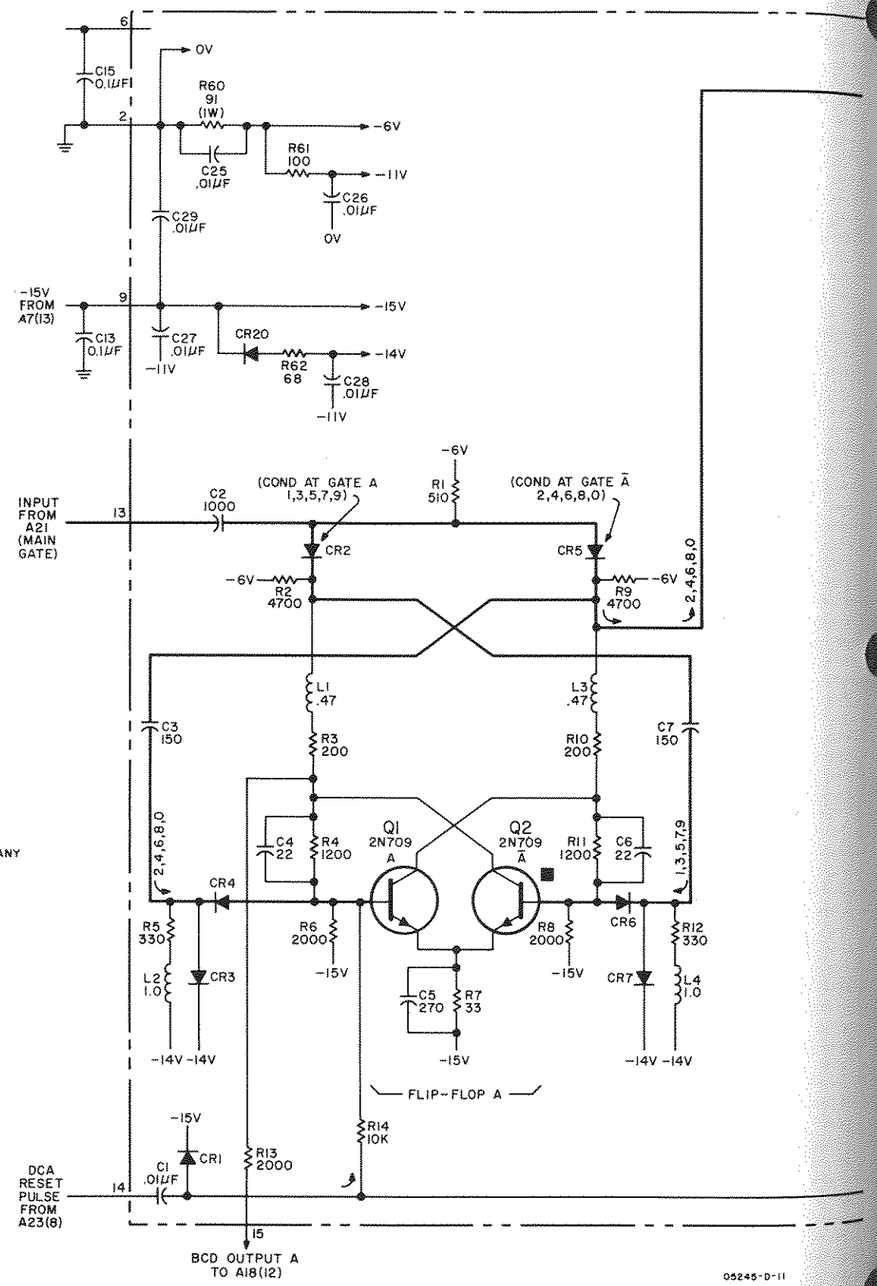


A17 DECIMAL COUNTER ASSEMBLY (5245A-65C)

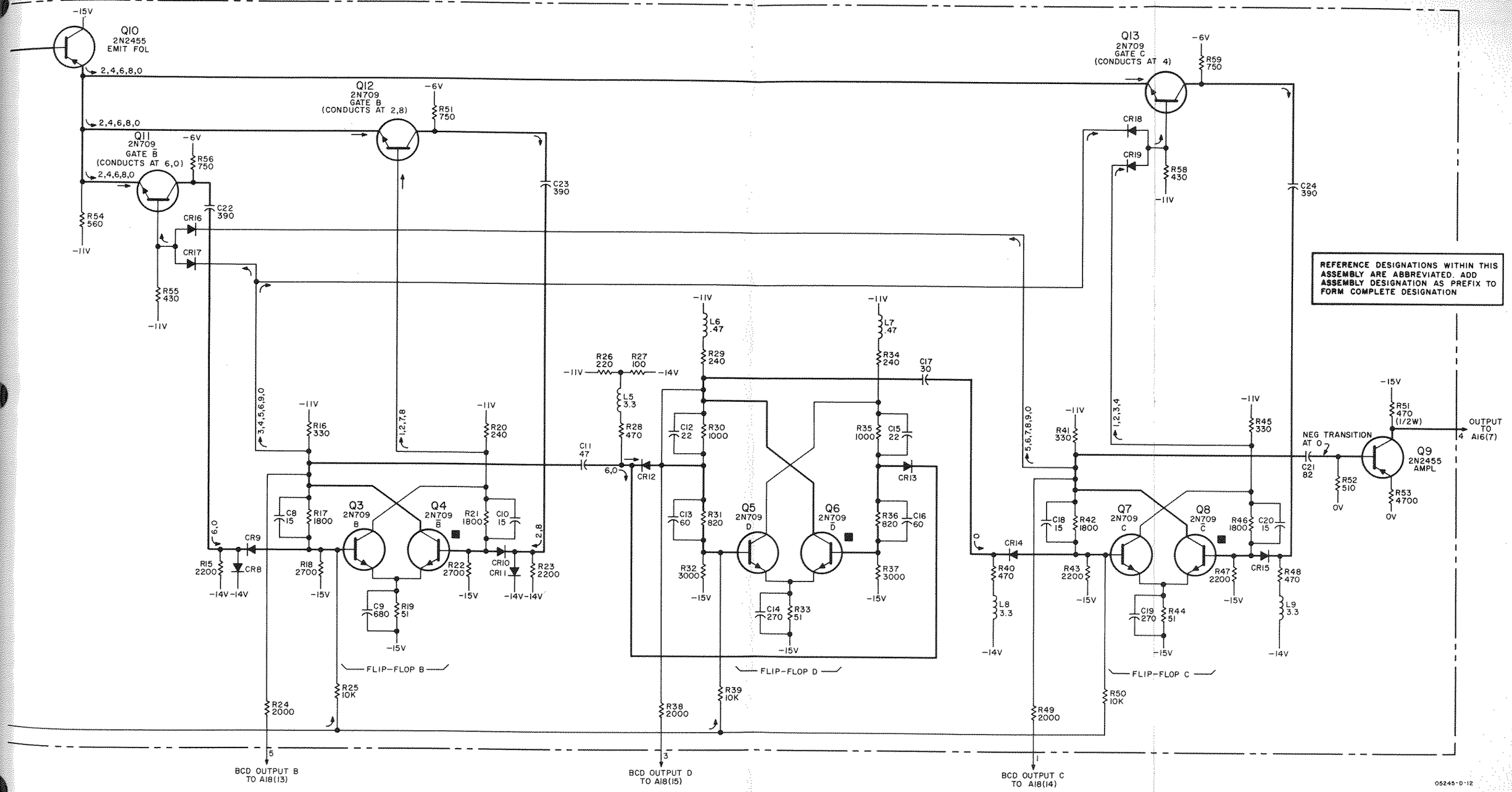
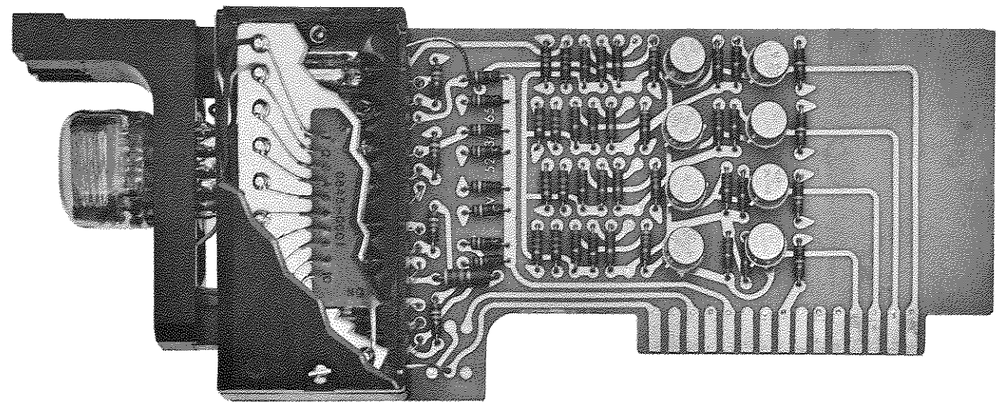

Q10 2N2455 EMIT FOL
Q11 2N709 GATE B (CONDUCTS AT 6,0)
Q12 2N709 GATE B (CONDUCTS AT 2,8)
Q13 2N709 GATE C (CONDUCTS AT 4)
Q3 2N709 B
Q4 2N709 B
Q5 2N709 D
Q6 2N709 D
Q7 2N709 C
Q8 2N709 C
Q9 2N2455 AMPL
FLIP-FLOP B
FLIP-FLOP D
FLIP-FLOP C
REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY DESIGNATION AS PREFIX TO FORM COMPLETE DESIGNATION
NEG TRANSITION AT 0
OUTPUT TO A16(7)
BCD OUTPUT B TO A18(13)
BCD OUTPUT D TO A18(15)
BCD OUTPUT C TO A18(14)
05245-D-12

Figure 5-23. Decimal Counter Assembly A17 (50 Mc)



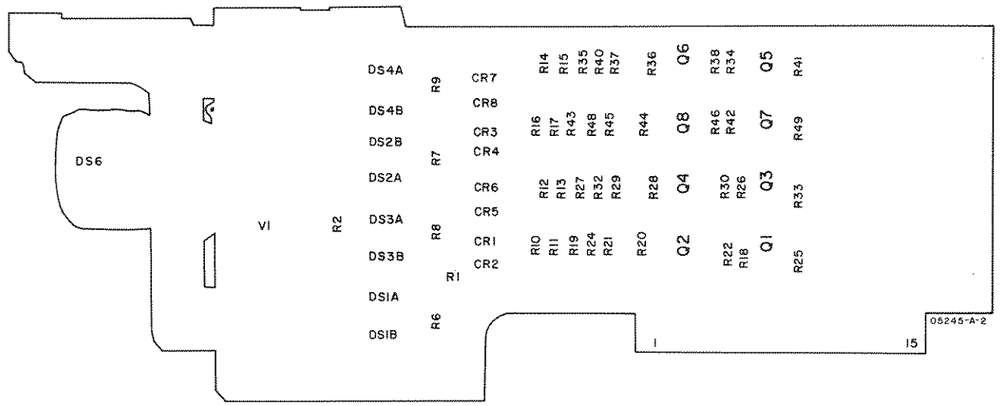
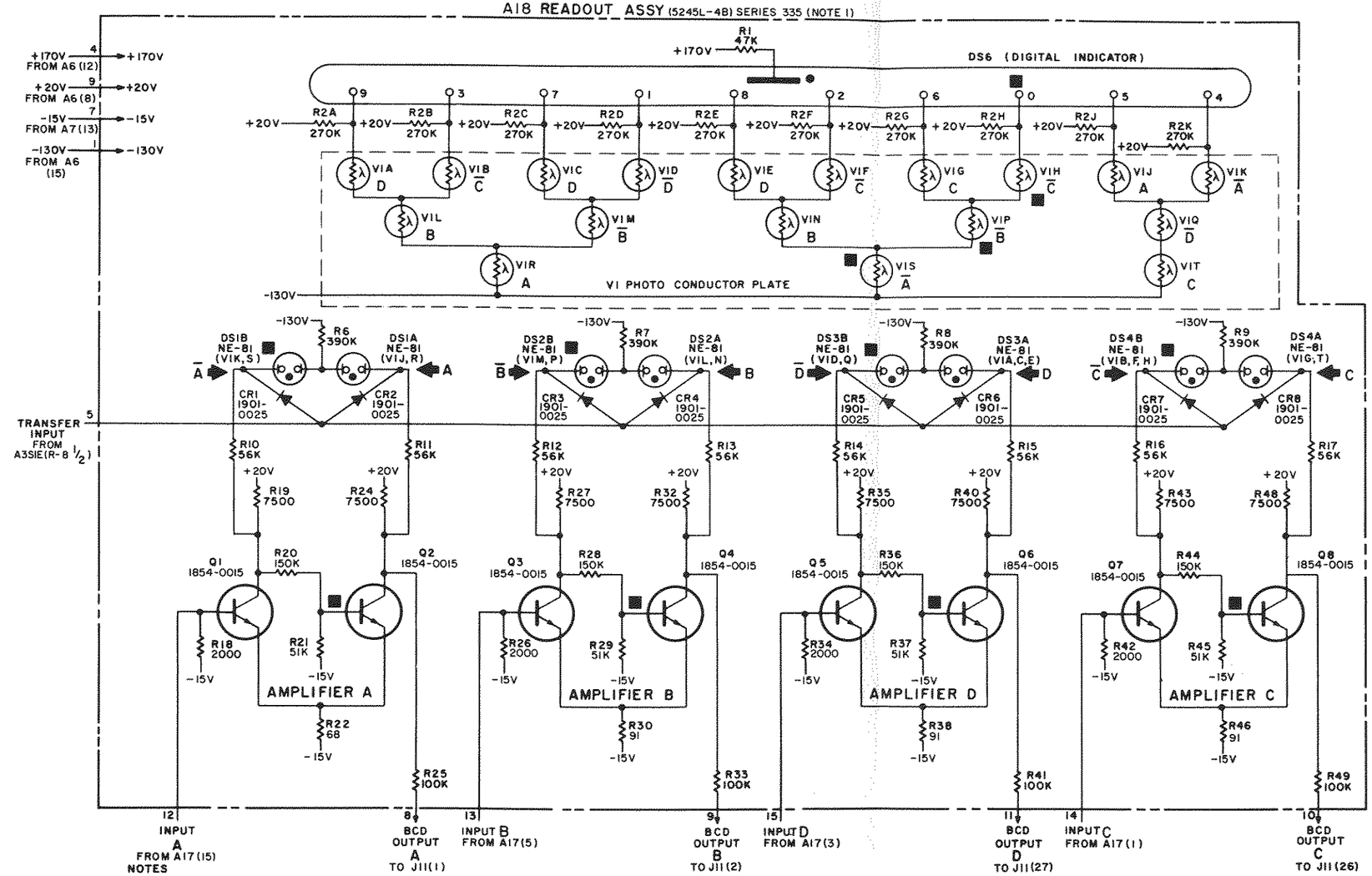


Figure 5-24. Readout Assembly A18, Component Location



NOTES

1. REFERENCE DESIGNATIONS WITHIN READOUT ASSEMBLY ARE INCOMPLETE; TO FORM COMPLETE REFERENCE DESIGNATION, ADD ASSEMBLY DESIGNATION A18 AS PREFIX TO INDICATED DESIGNATION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS
   RESISTORS 1/4 WATT
3. REFERENCE DESIGNATIONS IN PARENTHESES INDICATE LIGHT DESTINATION FOR DS1-DS4; LIGHT SOURCE IS NOTED NEAR EACH VI SECTION.
4. FILLED SQUARE (■) INDICATES CONDUCTING ELEMENT FOR DECIMAL "0" (BCD "0000").

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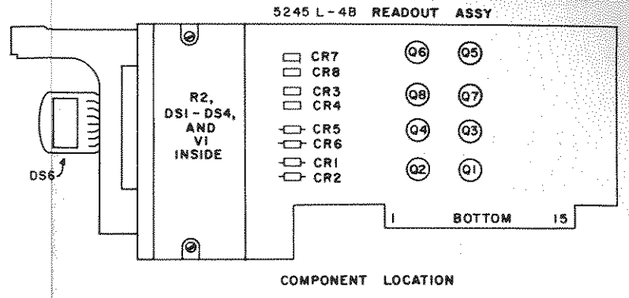
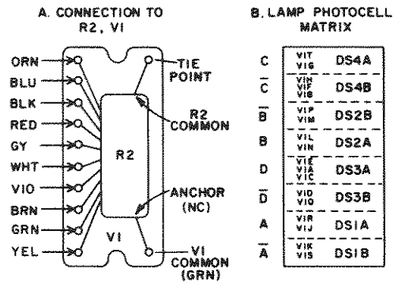


COMPONENT LOCATION

PHYSICAL LAYOUT



DIGIT	4 LINE CODE (0=−, 1=+) D	C	B	A	RELEVANT STAGES VI	AMPLIFIER D	C	B	A
0	0	0	0	0	HPS		■	■	■
1	0	0	0	1	DMR	■		■	■
2	0	0	1	0	FNS		■	■	■
3	0	0	1	1	BLR		■	■	■
4	0	1	1	0	KQT	■	■		■
5	0	1	1	1	JQT	■	■		■
6	1	1	0	0	GPS		■	■	■
7	1	1	0	1	CMR	■		■	■
8	1	1	1	0	ENS	■		■	■
9	1	1	1	1	ALR	■		■	■

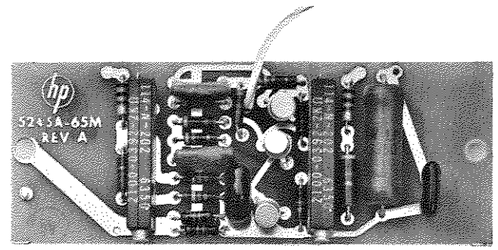
REFERENCE DESIGNATIONS

CR1 - 8
DS1 - 6
Q1 - 8
R1 - 49
VI

OMITTED:
DS5
R3-5,23,31,39,47

05245-D-27

Figure 5-25. Readout Assembly A18



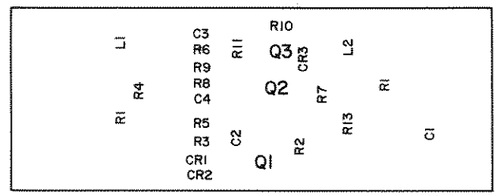
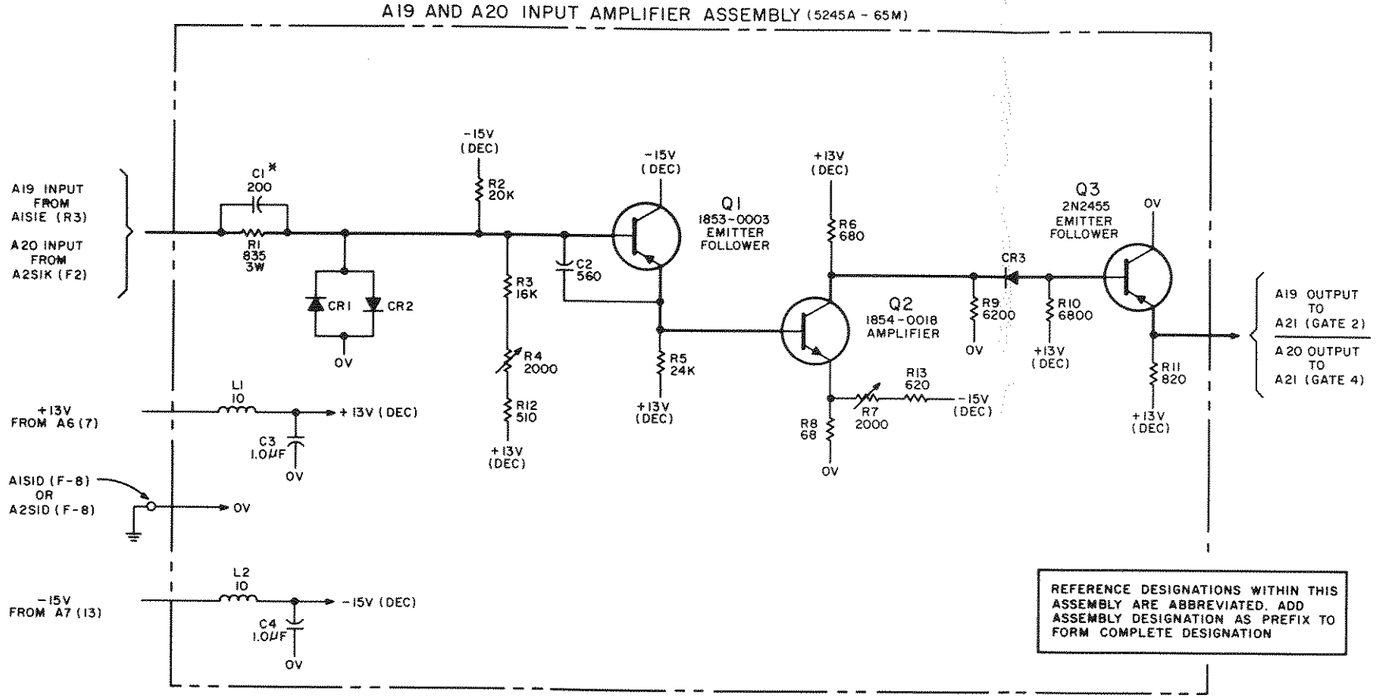


Figure 5-26. Input Amplifier Assembly A19, A20, Component Location



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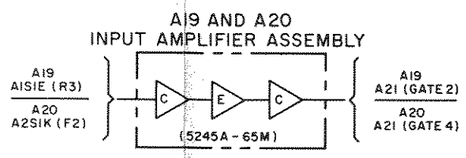


NOTES

1. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS
   INDUCTANCE IN MICROHENRIES
   RESISTOR 1/4 WATT

2. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

A19, A20
C1-4
CR1-3
L1,2
Q1-3
R1-13

05245-D-13

Figure 5-27. Input Amplifier Assembly A19, A20

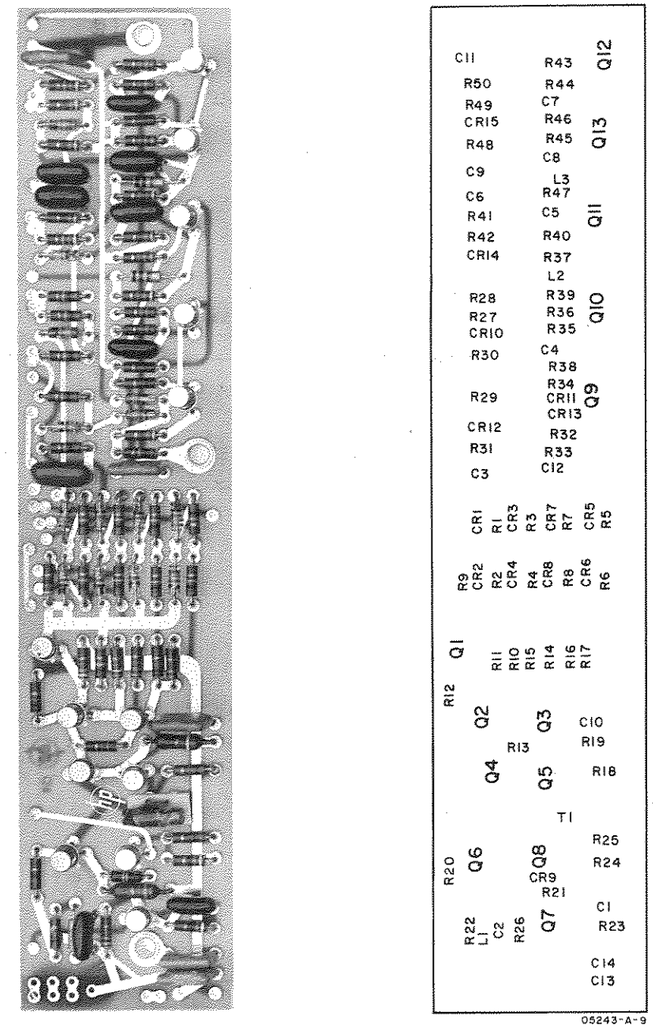
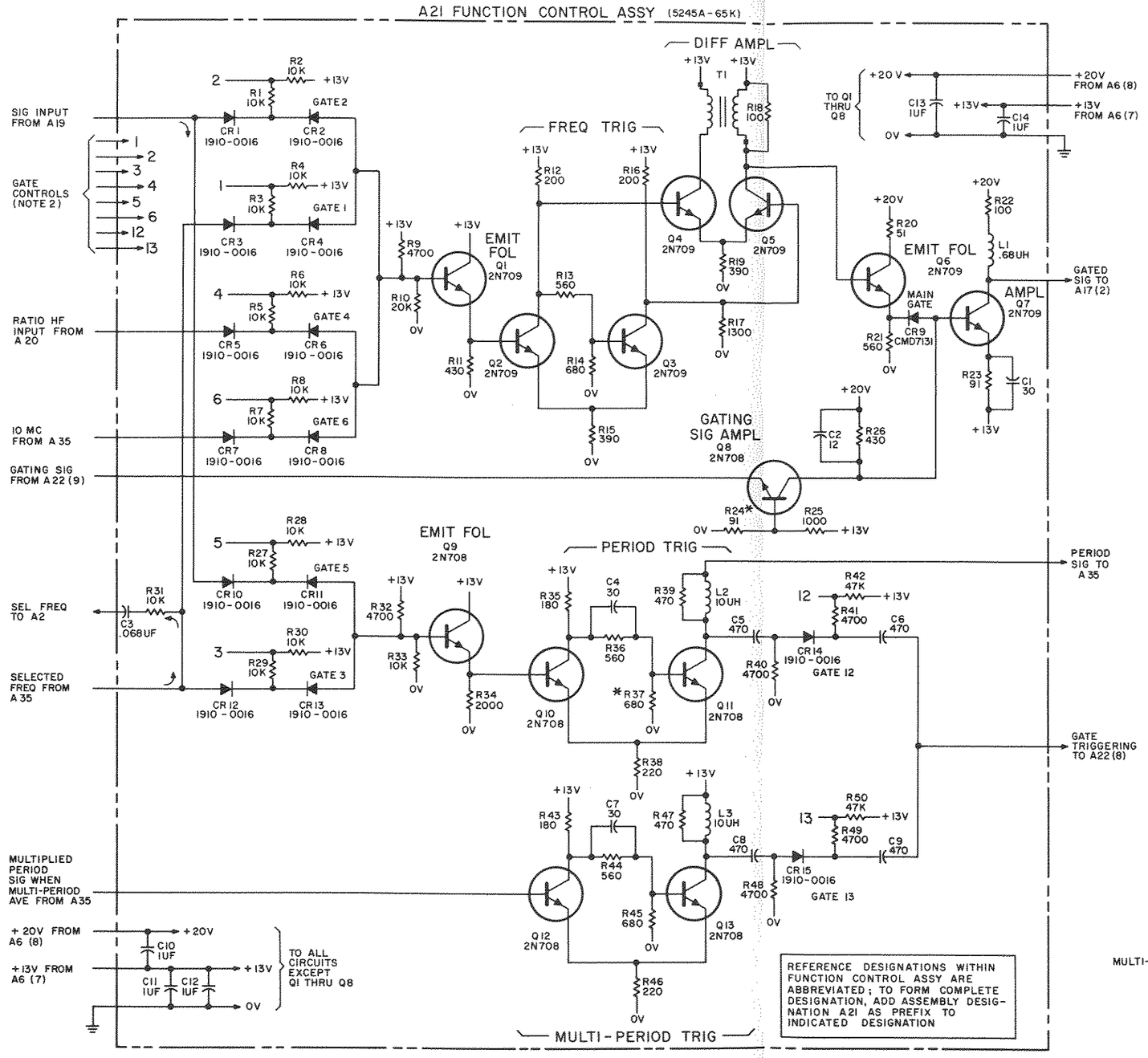
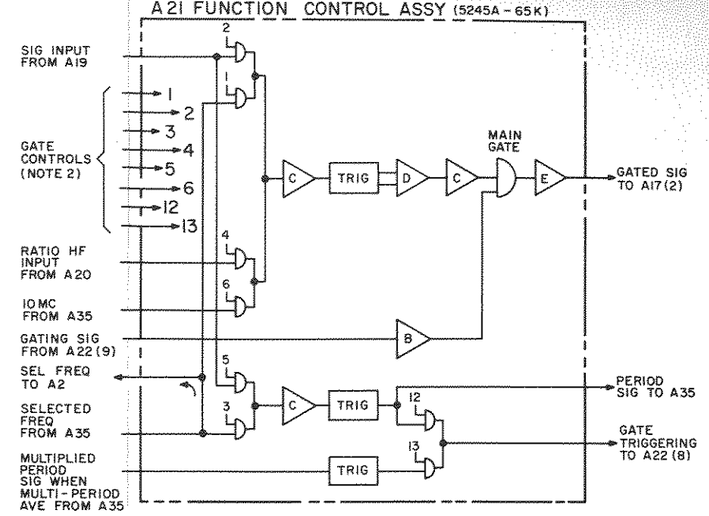


Figure 5-28. Function Control Assembly A21, Component Location


A21 FUNCTION CONTROL ASSY (5245A-65K)
SIG INPUT FROM A19
GATE CONTROLS (NOTE 2)
RATIO HF INPUT FROM A 20
10 MC FROM A 35
GATING SIG FROM A22 (9)
SEL FREQ TO A2
SELECTED FREQ FROM A 35
MULTIPLIED PERIOD SIG WHEN MULTI-PERIOD AVE FROM A35
+20V FROM A6 (8)
+13V FROM A6 (7)
TO ALL CIRCUITS EXCEPT Q1 THRU Q8
DIFF AMPL
FREQ TRIG
EMIT FOL Q1 2N709
EMIT FOL Q9 2N708
PERIOD TRIG
MULTI-PERIOD TRIG
GATING SIG AMPL Q8 2N708
EMIT FOL Q6 2N709
MAIN GATE
AMPL Q7 2N709
TO Q1 THRU Q8
+20V FROM A6 (8)
+13V FROM A6 (7)
GATED SIG TO A17 (2)
PERIOD SIG TO A35
GATE TRIGGERING TO A22 (8)
REFERENCE DESIGNATIONS WITHIN FUNCTION CONTROL ASSY ARE ABBREVIATED; TO FORM COMPLETE DESIGNATION, ADD ASSEMBLY DESIGNATION A21 AS PREFIX TO INDICATED DESIGNATION


A21 FUNCTION CONTROL ASSY (5245A-65K)
SIG INPUT FROM A19
GATE CONTROLS (NOTE 2)
RATIO HF INPUT FROM A20
10MC FROM A35
GATING SIG FROM A22 (9)
SEL FREQ TO A2
SELECTED FREQ FROM A35
MULTIPLIED PERIOD SIG WHEN MULTI-PERIOD AVE FROM A35
MAIN GATE
GATED SIG TO A17 (2)
PERIOD SIG TO A35
GATE TRIGGERING TO A22 (8)

REFERENCE DESIGNATIONS

C1 - 14
CR1 - 15
L1 - 3
Q1 - 13
R1 - 50
T1

NOTES

1. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS; RESISTORS 1/4 WATT
2. SEE TABLE ON OVERALL DIAGRAM FIG 5-5 FOR COMPLETE DESCRIPTION OF GATE CONTROLS
3. ASTERISK (*) INDICATES SELECTED VALUE

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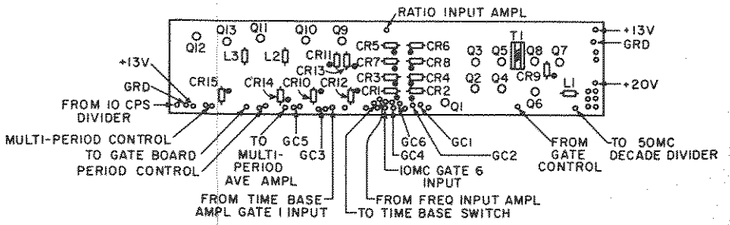
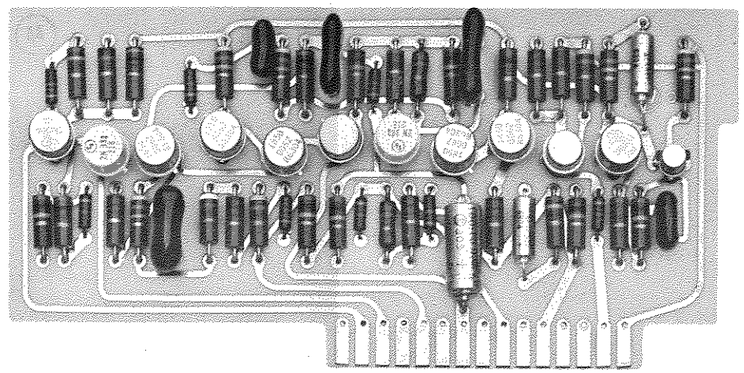
COMPONENT LOCATION (5245A-65K), FROM BOTTOM-REAR
DOT INDICATES DIODE CATHODE



05245-D-6

Figure 5-29. Function Control Assembly A21



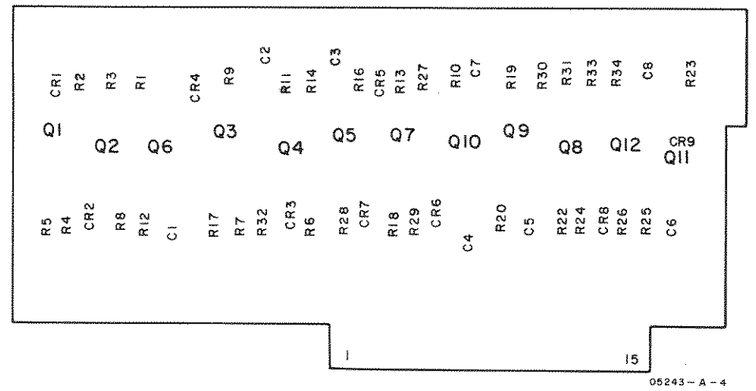
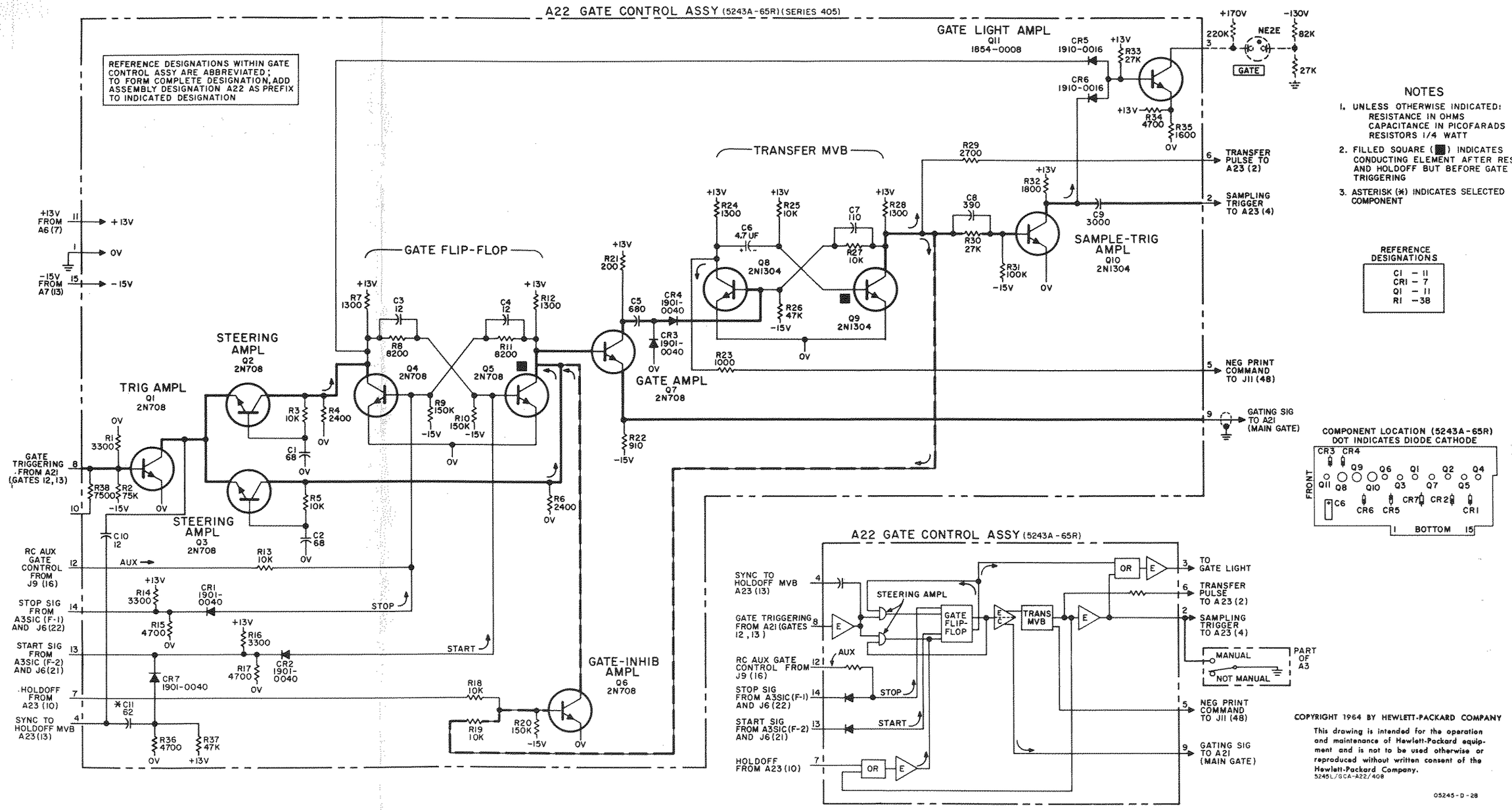


Figure 5-30. Sampling Control Assembly A23, Component Location


A22 GATE CONTROL ASSY (5243A-65R) (SERIES 405)
REFERENCE DESIGNATIONS WITHIN GATE CONTROL ASSY ARE ABBREVIATED; TO FORM COMPLETE DESIGNATION, ADD ASSEMBLY DESIGNATION A22 AS PREFIX TO INDICATED DESIGNATION
GATE LIGHT AMPL Q11 1854-0008
TRANSFER MVB
GATE FLIP-FLOP
STEERING AMPL Q2 2N708
TRIG AMPL Q1 2N708
STEERING AMPL Q3 2N708
GATE AMPL Q7 2N708
GATE-INHIB AMPL Q6 2N708
SAMPLE-TRIG AMPL Q10 2N1304
Q8 2N1304
Q9 2N1304
Q4 2N708
Q5 2N708
+13V FROM A6(7)
-15V FROM A7(13)
GATE TRIGGERING FROM A21 (GATES 12,13)
RC AUX GATE CONTROL FROM J9(16)
STOP SIG FROM A3SIC(F-1) AND J6(22)
START SIG FROM A3SIC(F-2) AND J6(21)
HOLDOFF FROM A23(10)
SYNC TO HOLDOFF MVB A23(13)
TRANSFER PULSE TO A23(2)
SAMPLING TRIGGER TO A23(4)
NEG PRINT COMMAND TO J11(48)
GATING SIG TO A21 (MAIN GATE)
GATE
NE2E
+170V
-130V
REFERENCE DESIGNATIONS
C1 - 11
CR1 - 7
Q1 - 11
R1 - 38
NOTES
1. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS CAPACITANCE IN PICOFARADS RESISTORS 1/4 WATT
2. FILLED SQUARE (■) INDICATES CONDUCTING ELEMENT AFTER RESET AND HOLDOFF BUT BEFORE GATE TRIGGERING
3. ASTERISK (*) INDICATES SELECTED COMPONENT
COMPONENT LOCATION (5243A-65R)
DOT INDICATES DIODE CATHODE
FRONT
BOTTOM
A22 GATE CONTROL ASSY (5243A-65R)
SYNC TO HOLDOFF MVB A23(13)
GATE TRIGGERING FROM A21(GATES 12,13)
RC AUX GATE CONTROL FROM J9(16)
STOP SIG FROM A3SIC(F-1) AND J6(22)
START SIG FROM A3SIC(F-2) AND J6(21)
HOLDOFF FROM A23(10)
STEERING AMPL
GATE FLIP-FLOP
TRANS MVB
OR
TO GATE LIGHT
TRANSFER PULSE TO A23(2)
SAMPLING TRIGGER TO A23(4)
MANUAL
NOT MANUAL
PART OF A3
NEG PRINT COMMAND TO J11(48)
GATING SIG TO A21 (MAIN GATE)
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5245L/GCA-A22/408
05245-D-28

Figure 5-31. Gate Control Assembly A22

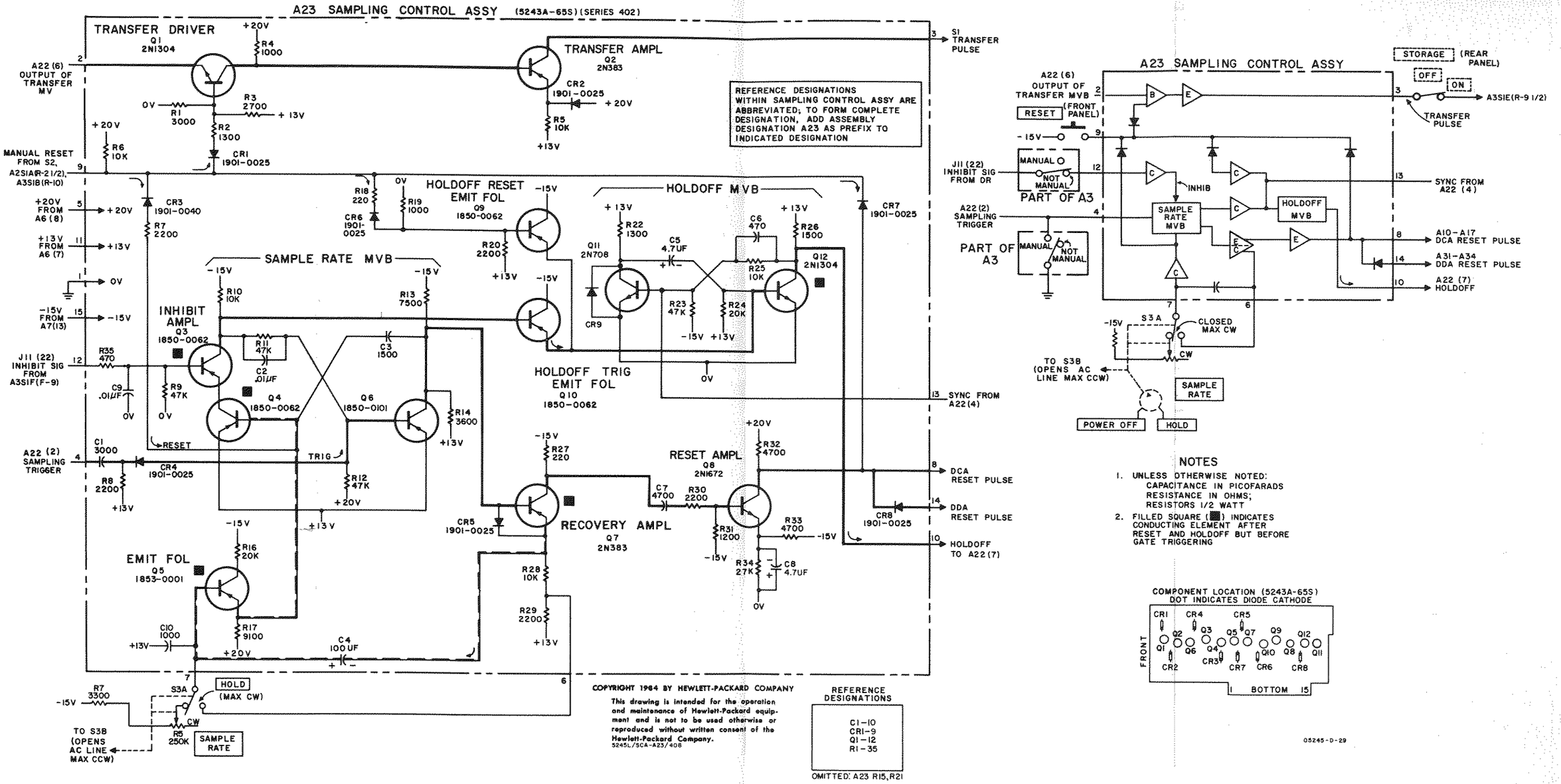
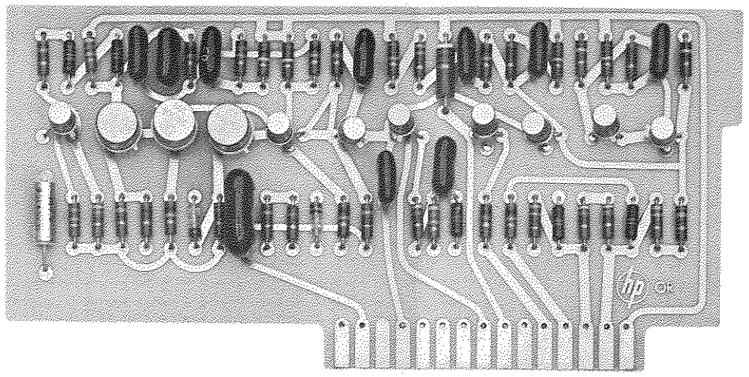


Figure 5-32. Sampling Control Assembly A23



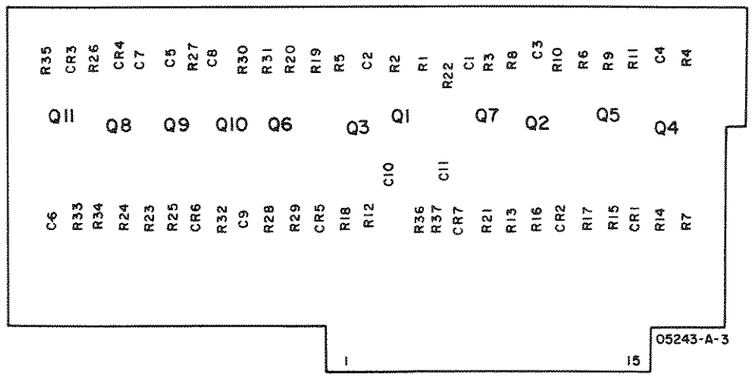
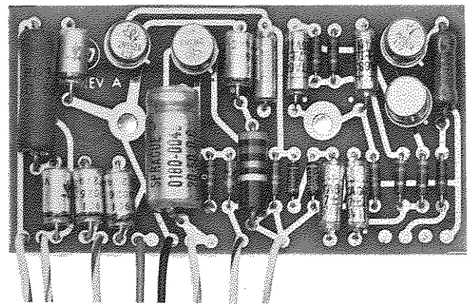
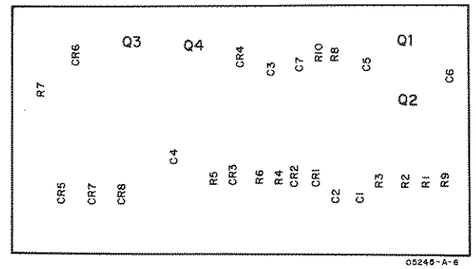


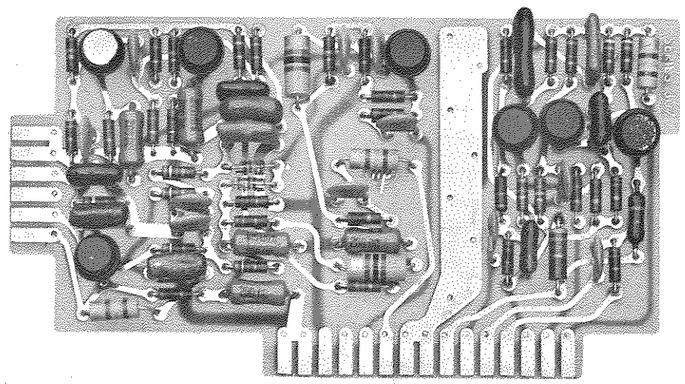
Figure 5-33. Gate Control Assembly A22, Component Location

A25





A26



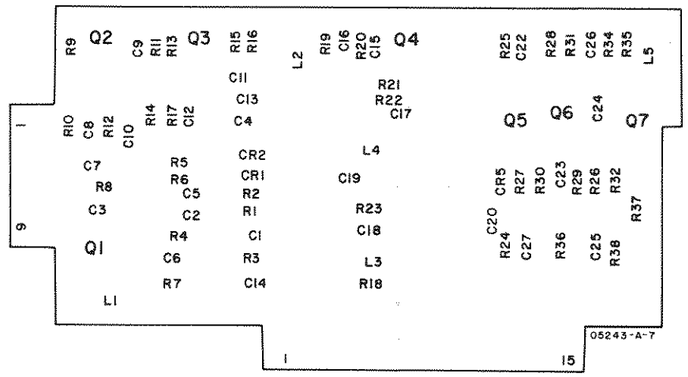
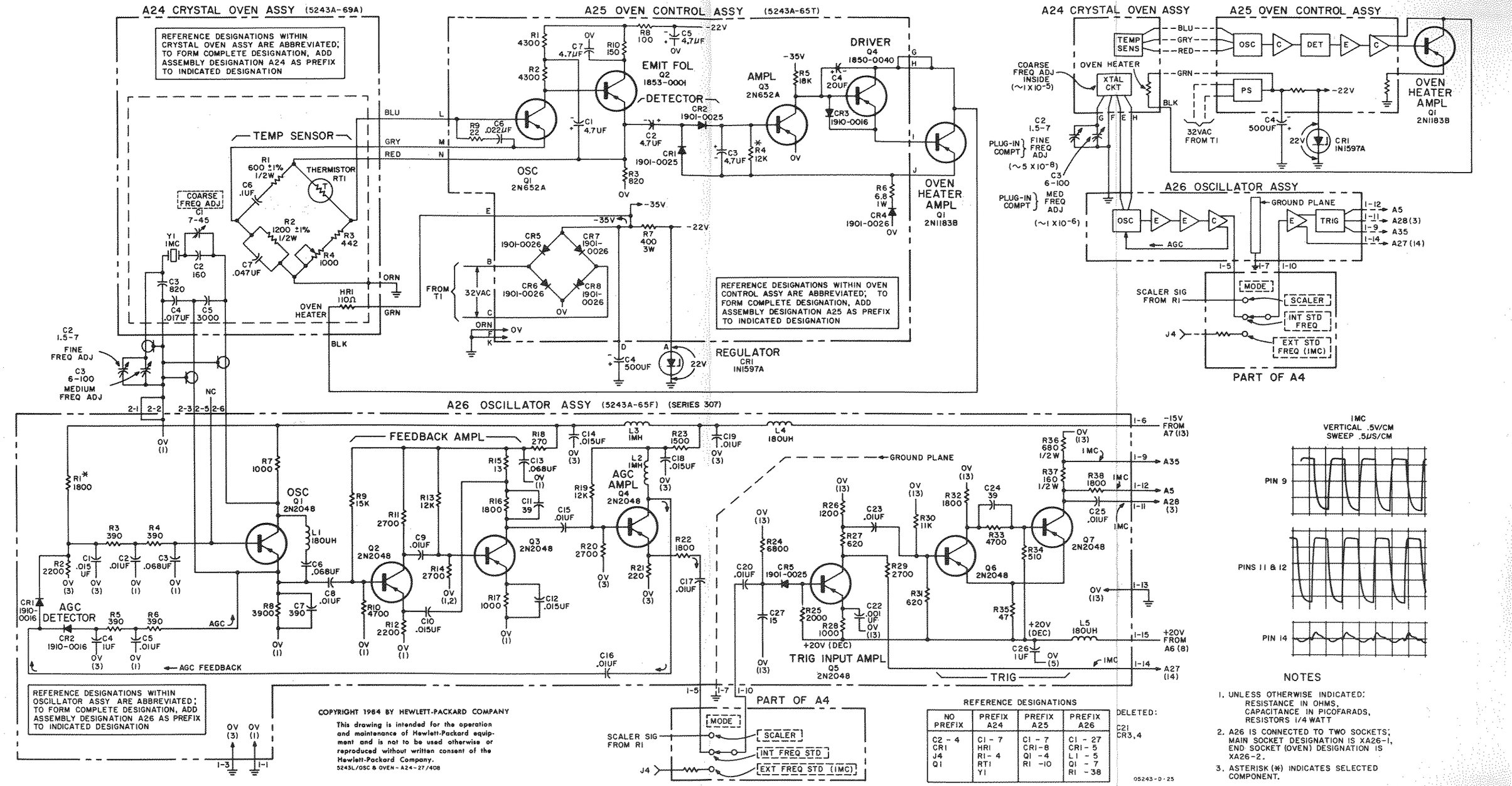


Figure 5-34. Oven Control Assembly A25 and Oscillator Assembly A26 Component Location



REFERENCE DESIGNATIONS

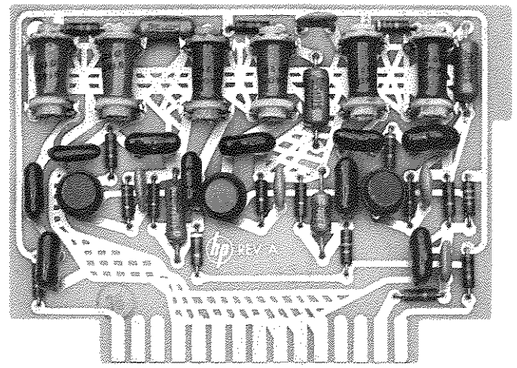
NO PREFIX	PREFIX A24	PREFIX A25	PREFIX A26
C2 - 4	C1 - 7	C1 - 7	C1 - 27
CR1	HR1	CR1 - 8	CR1 - 5
J4	R1 - 4	Q1 - 4	L1 - 5
Q1	RT1	R1 -10	Q1 - 7
	Y1		R1 - 38

DELETED:
C21
CR3,4

NOTES

1. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS, RESISTORS 1/4 WATT
2. A26 IS CONNECTED TO TWO SOCKETS; MAIN SOCKET DESIGNATION IS XA26-1, END SOCKET (OVEN) DESIGNATION IS XA26-2.
3. ASTERISK (*) INDICATES SELECTED COMPONENT.

Figure 5-35. Crystal Oven Assembly A24, Oven Control Assembly A25, and Oscillator Assembly A26



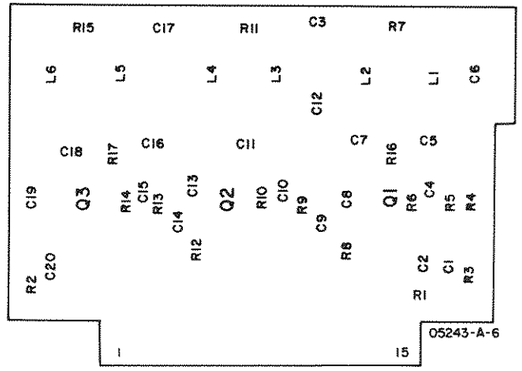
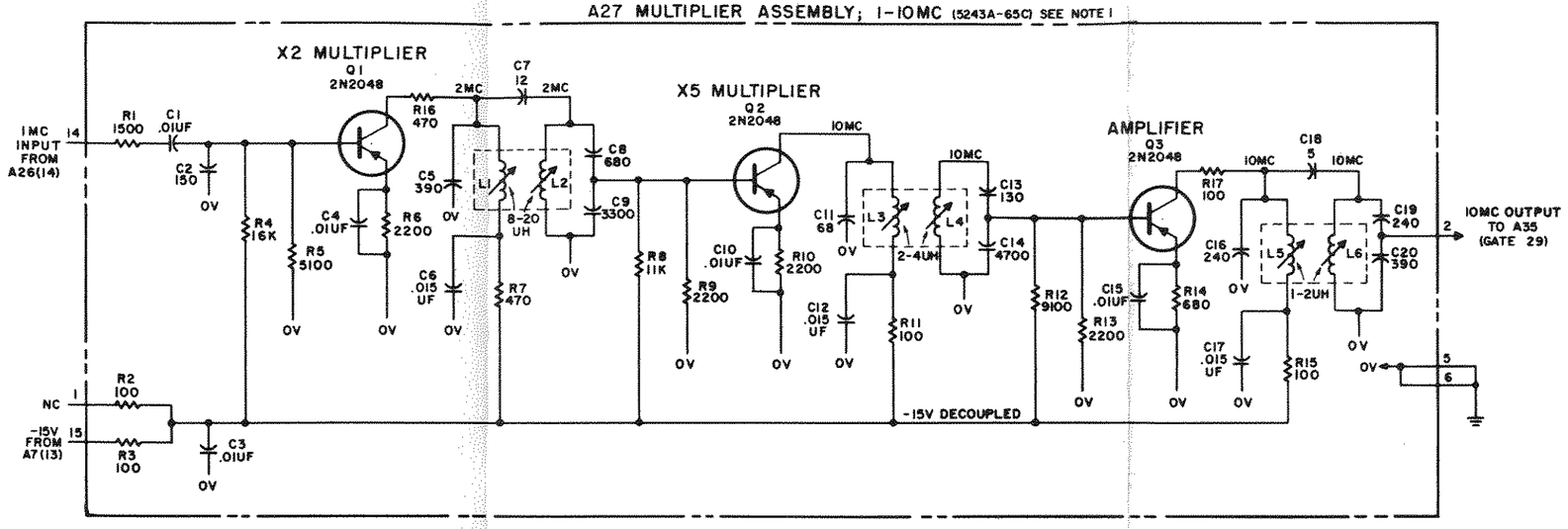


Figure 5-36. Multiplier Assembly A27
Component Location



REFERENCE DESIGNATIONS

C	20
L	6
Q	3
R	17

NOTES

1. REFERENCE DESIGNATIONS WITHIN MULTIPLIER ASSEMBLY ARE INCOMPLETE; TO FORM COMPLETE REFERENCE DESIGNATION, ADD ASSEMBLY DESIGNATION A27 AS PREFIX TO INDICATED DESIGNATION.
2. L1-L2; L3-L4; L5-L6 ARE MUTUALLY COUPLED.
3. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   RESISTORS 1/4 WATT

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5245L/MULT-A27/408

05246-D-19

Figure 5-37. Multiplier Assembly A27

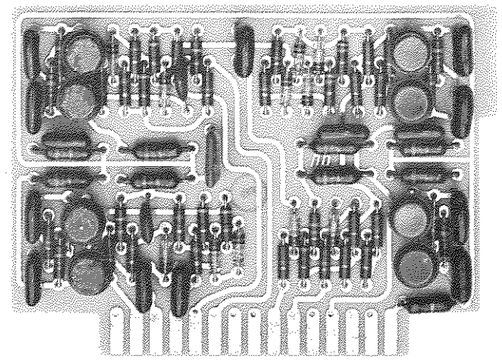
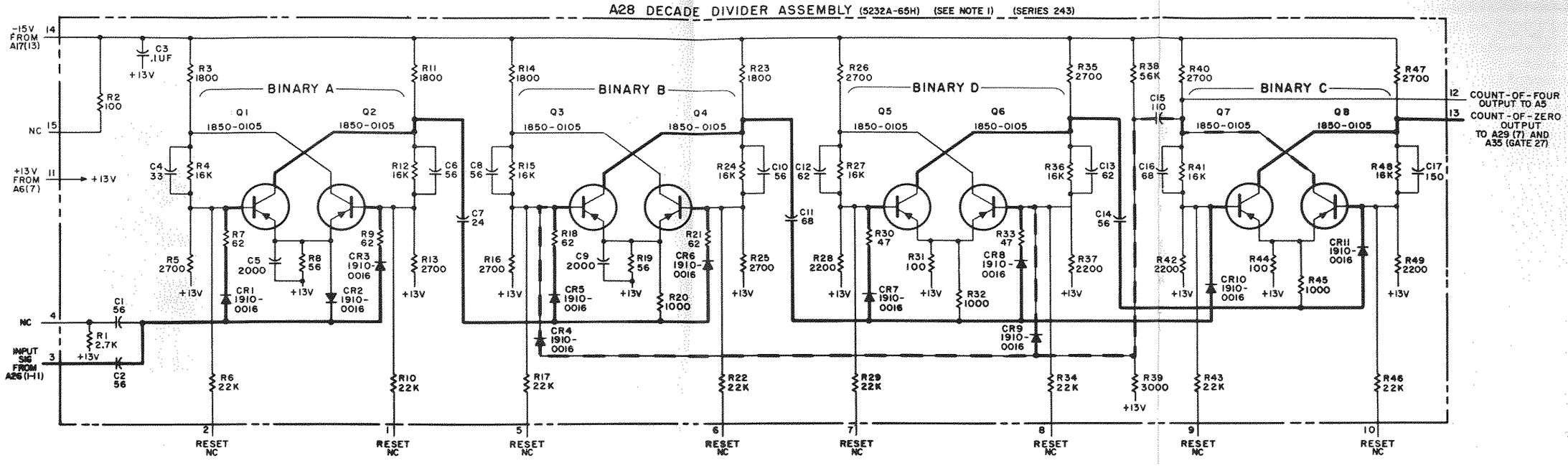


Figure 5-38. Decade Divider Assembly A28, Component Location



NOTES

1. REFERENCE DESIGNATIONS WITHIN DECADE DIVIDER ASSEMBLY ARE INCOMPLETE; TO FORM COMPLETE REFERENCE DESIGNATION, ADD APPROPRIATE ASSEMBLY DESIGNATION (A28) AS PREFIX TO INDICATED DESIGNATION. ASSEMBLY DESIGNATION IS SHOWN IN FIGURE CAPTION AND ON OVERALL FUNCTIONAL SCHEMATIC.
2. TYPICAL EXTERNAL CONNECTIONS ARE SHOWN; FOR EXACT CONNECTION AND REFERENCE DESIGNATIONS OF EXTERNAL COMPONENTS, REFER TO OVERALL FUNCTIONAL SCHEMATIC.
3. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS
   CAPACITANCE IN PICOFARADS;
   RESISTORS 1/4 WATT.

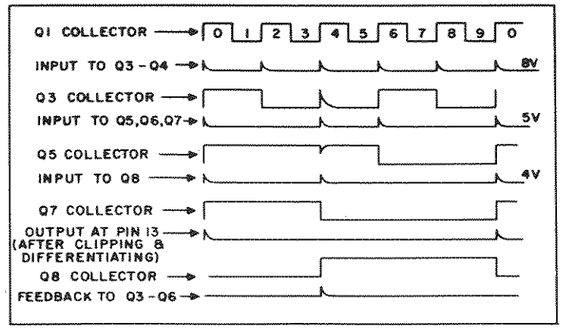
RESET WIRING

RESET NUMERAL	RESET PULSE (NEGATIVE) PIN CONNECTIONS			
0	2	5	7	9
1	1	5	7	9
2	2	6	7	9
3	1	6	7	9
4	2	6	7	10
5	1	6	7	10
6	2	5	8	10
7	1	5	8	10
8	2	6	8	10
9	1	6	8	10

REFERENCE DESIGNATIONS (NOTE 1)

C1 – C17
CR1 – CR11
Q1 – Q8
R1 – R49

WAVEFORMS



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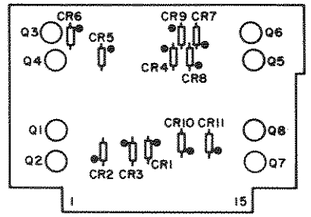
5232A-65H
COMPONENT LOCATION



*DOT INDICATES DIODE CATHODE

05243-D-28

Figure 5-39. Decade Divider Assembly A28

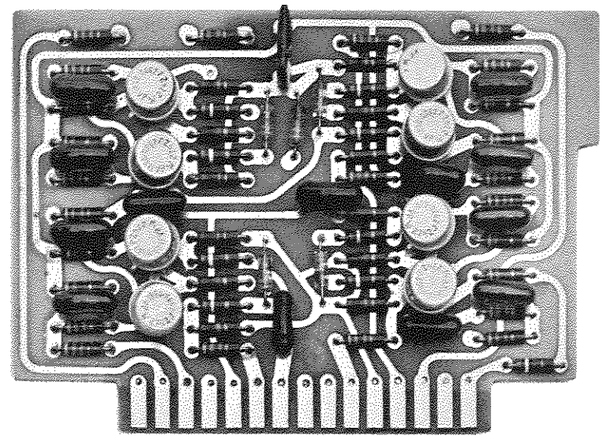
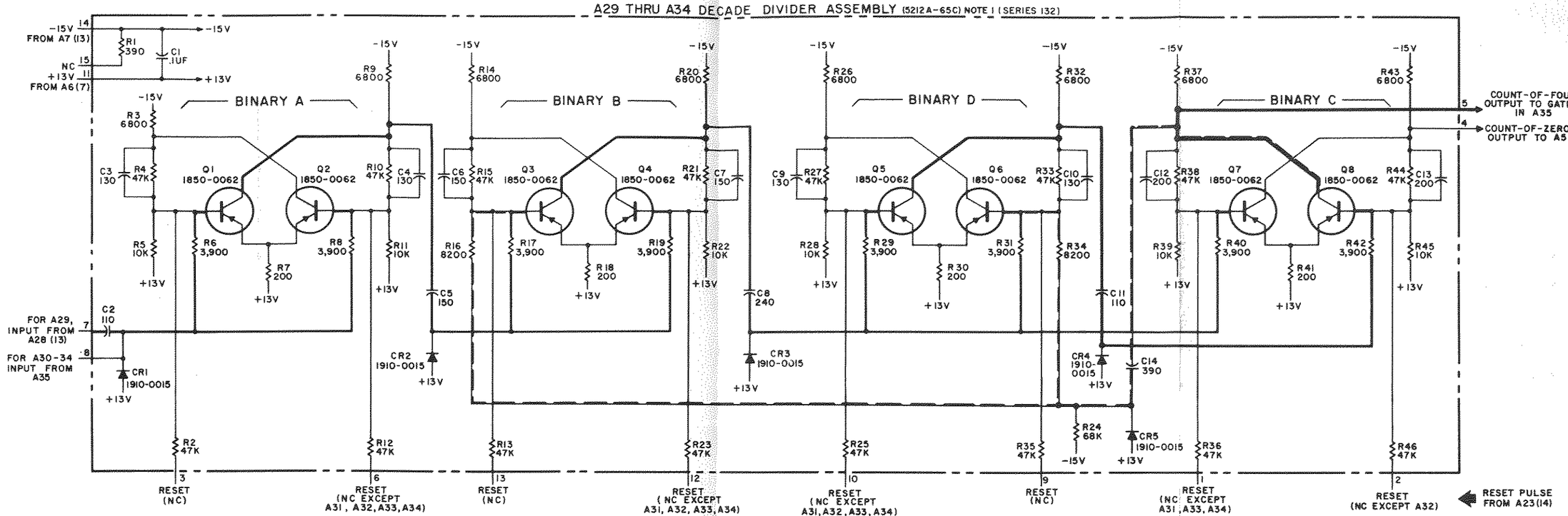


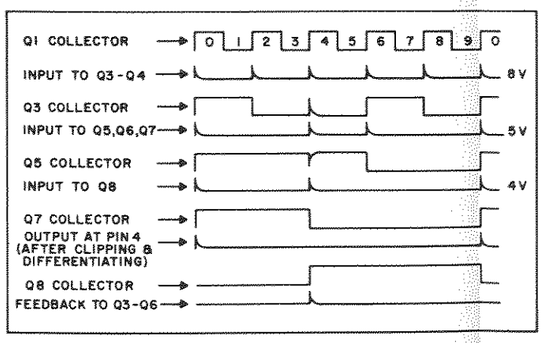
Figure 5-40. Decade Divider Assembly A29-A34, Component Location


A29 THRU A34 DECADE DIVIDER ASSEMBLY (5212A-65C) NOTE 1 (SERIES 132)
-15V FROM A7 (13)
NC
+13V FROM A6 (7)
BINARY A
BINARY B
BINARY D
BINARY C
COUNT-OF-FOUR OUTPUT TO GATES IN A35
COUNT-OF-ZERO OUTPUT TO A5
FOR A29, INPUT FROM A28 (13)
FOR A30-34 INPUT FROM A35
RESET (NC)
RESET (NC EXCEPT A31, A32, A33, A34)
RESET (NC EXCEPT A32)
RESET PULSE FROM A23(14)

NOTES

1. REFERENCE DESIGNATIONS WITHIN DECADE DIVIDER ASSY ARE INCOMPLETE; TO FORM COMPLETE REFERENCE DESIGNATION, ADD APPROPRIATE ASSEMBLY DESIGNATION (A29, A30, A31, A32, A33 OR A34) AS PREFIX TO INDICATED DESIGNATION; ASSEMBLY DESIGNATION IS SHOWN ON OVERALL FUNCTIONAL SCHEMATIC.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS
   CAPACITANCE IN PICOFARADS
   RESISTORS 1/4 WATT

WAVEFORMS



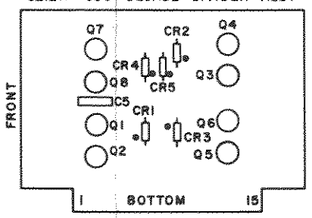
RESET WIRING

RESET NUMERAL	RESET PULSE (NEGATIVE) PIN CONNECTIONS			
0	3	13	10	1
1	6	13	10	1
2	3	12	10	1
3	6	12	10	1
4	3	12	10	2
5	6	12	10	2
6	3	13	9	2
7	6	13	9	2
8	3	12	9	2
9	6	12	9	2

REFERENCE DESIGNATIONS (NOTE 1)

C1 - 14
CR1 - 5
Q1 - 8
R1 - 46

5212A-65C DECADE DIVIDER ASSY



COMPONENT LOCATION

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5245L / DDA-A29-34/408

05245-D-21

Figure 5-41. Decade Divider Assembly A29-A34

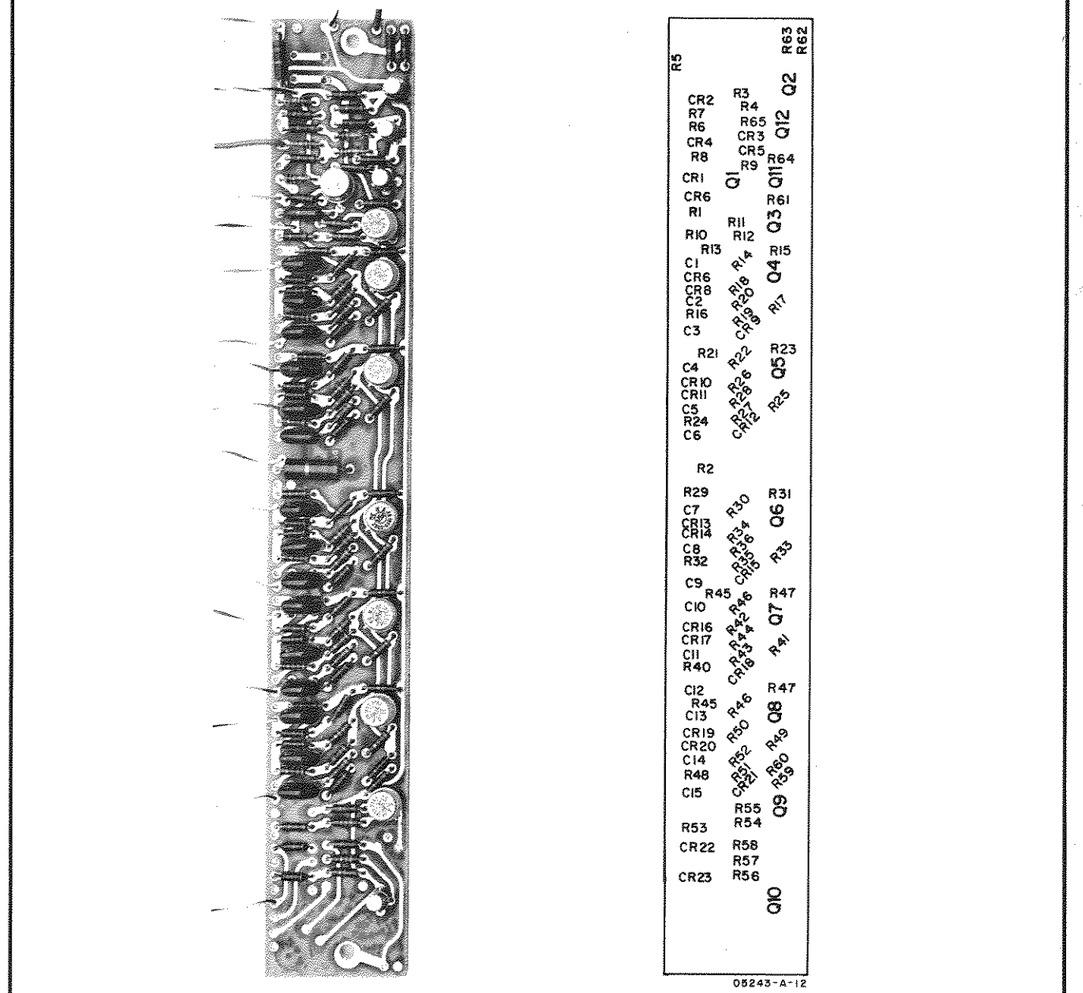
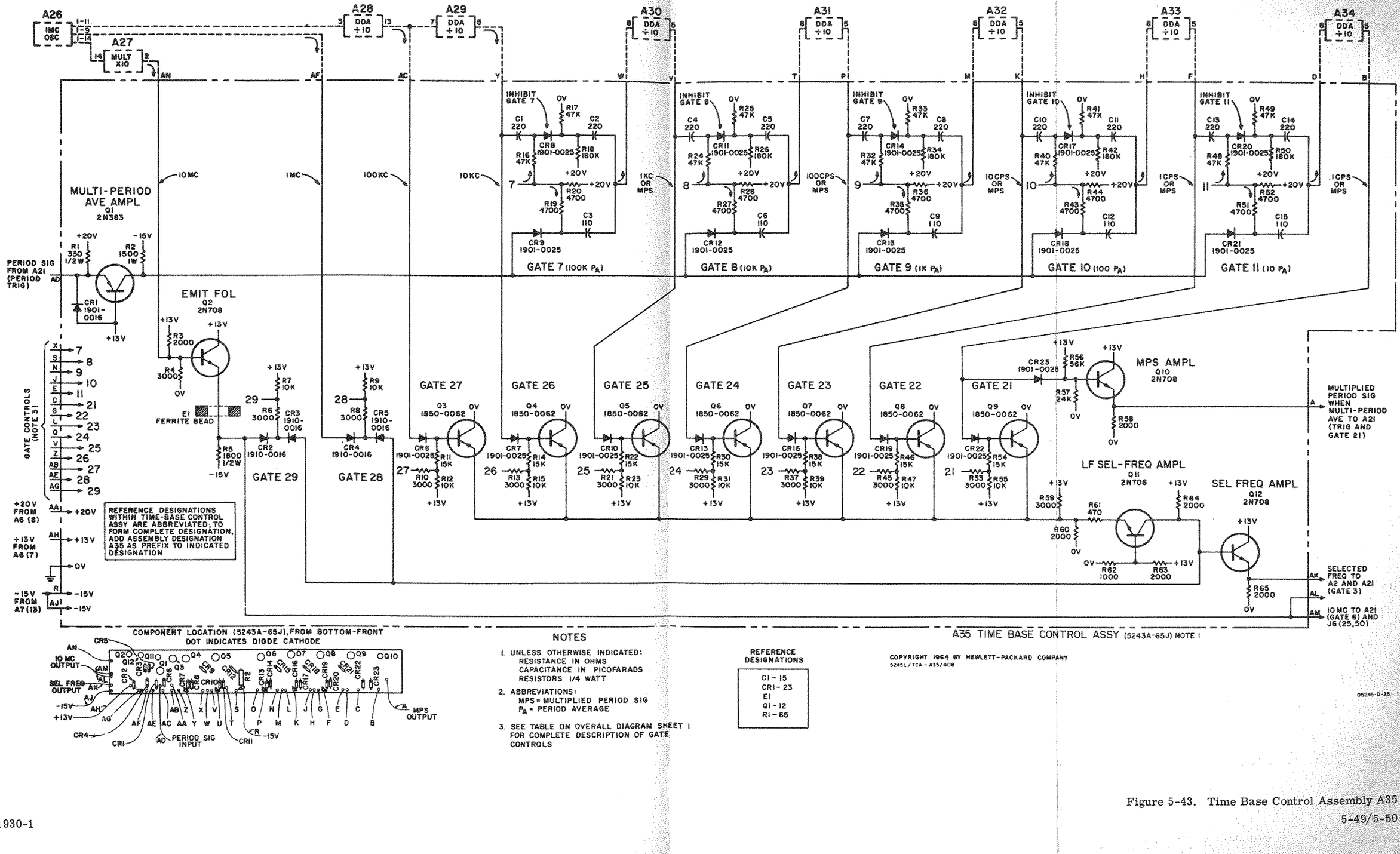


Figure 5-42. Time Base Control Assembly A35, Component Location



COMPONENT LOCATION (5243A-65J), FROM BOTTOM-FRONT
DOT INDICATES DIODE CATHODE

NOTES

1. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS
   CAPACITANCE IN PICOFARADS
   RESISTORS 1/4 WATT
2. ABBREVIATIONS:
   MPS = MULTIPLIED PERIOD SIG
   P_A = PERIOD AVERAGE
3. SEE TABLE ON OVERALL DIAGRAM SHEET 1 FOR COMPLETE DESCRIPTION OF GATE CONTROLS

REFERENCE DESIGNATIONS

C1 - 15
CR1 - 23
E1
Q1 - 12
R1 - 65

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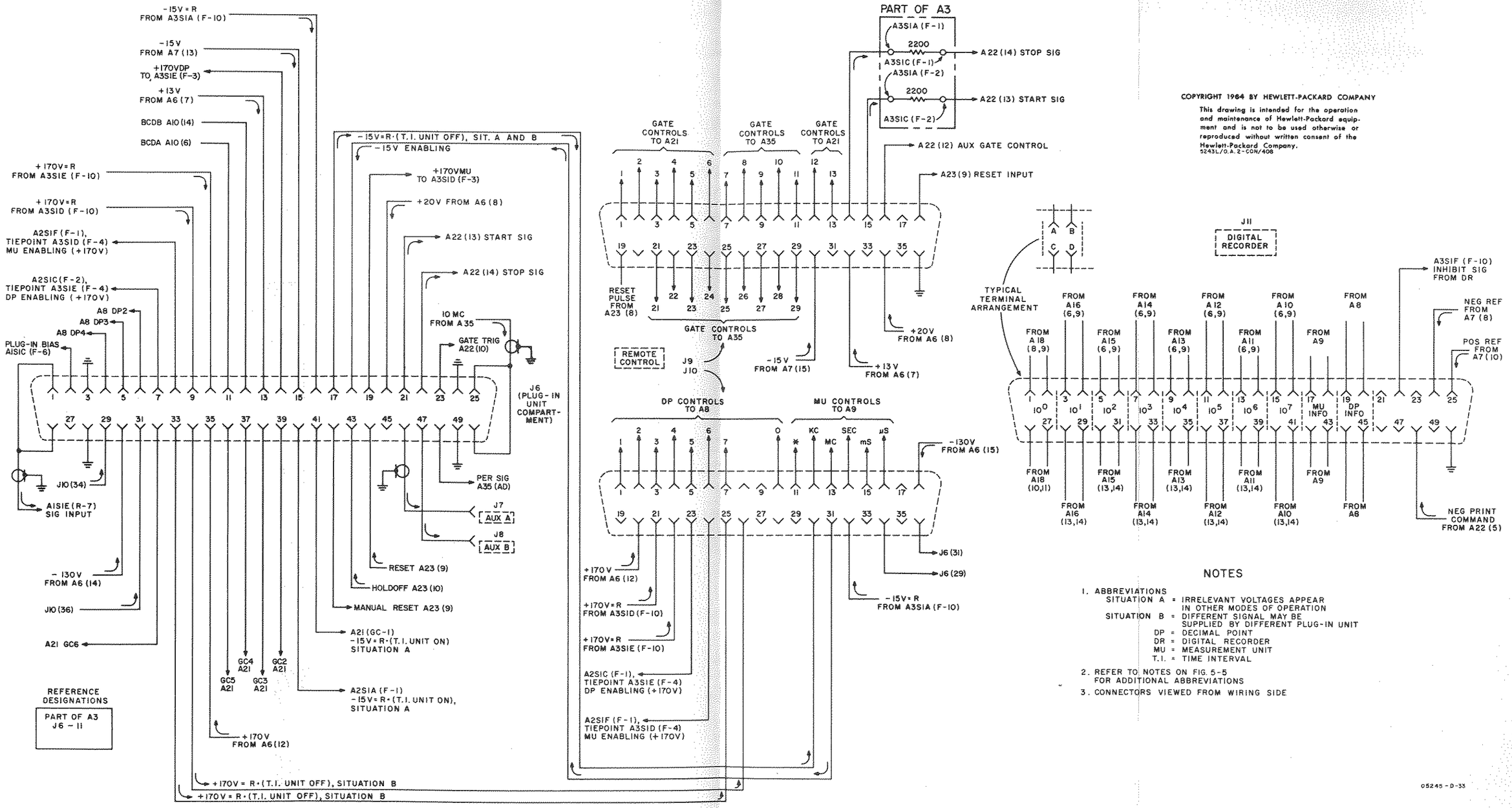
05245-D-23

Figure 5-43. Time Base Control Assembly A35



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NOTES

1. ABBREVIATIONS
   - SITUATION A = IRRELEVANT VOLTAGES APPEAR IN OTHER MODES OF OPERATION
   - SITUATION B = DIFFERENT SIGNAL MAY BE SUPPLIED BY DIFFERENT PLUG-IN UNIT
   - DP = DECIMAL POINT
   - DR = DIGITAL RECORDER
   - MU = MEASUREMENT UNIT
   - T.I. = TIME INTERVAL
2. REFER TO NOTES ON FIG. 5-5 FOR ADDITIONAL ABBREVIATIONS
3. CONNECTORS VIEWED FROM WIRING SIDE

05245-D-33

Figure 5-44. Connectors J6, J9, J10, J11

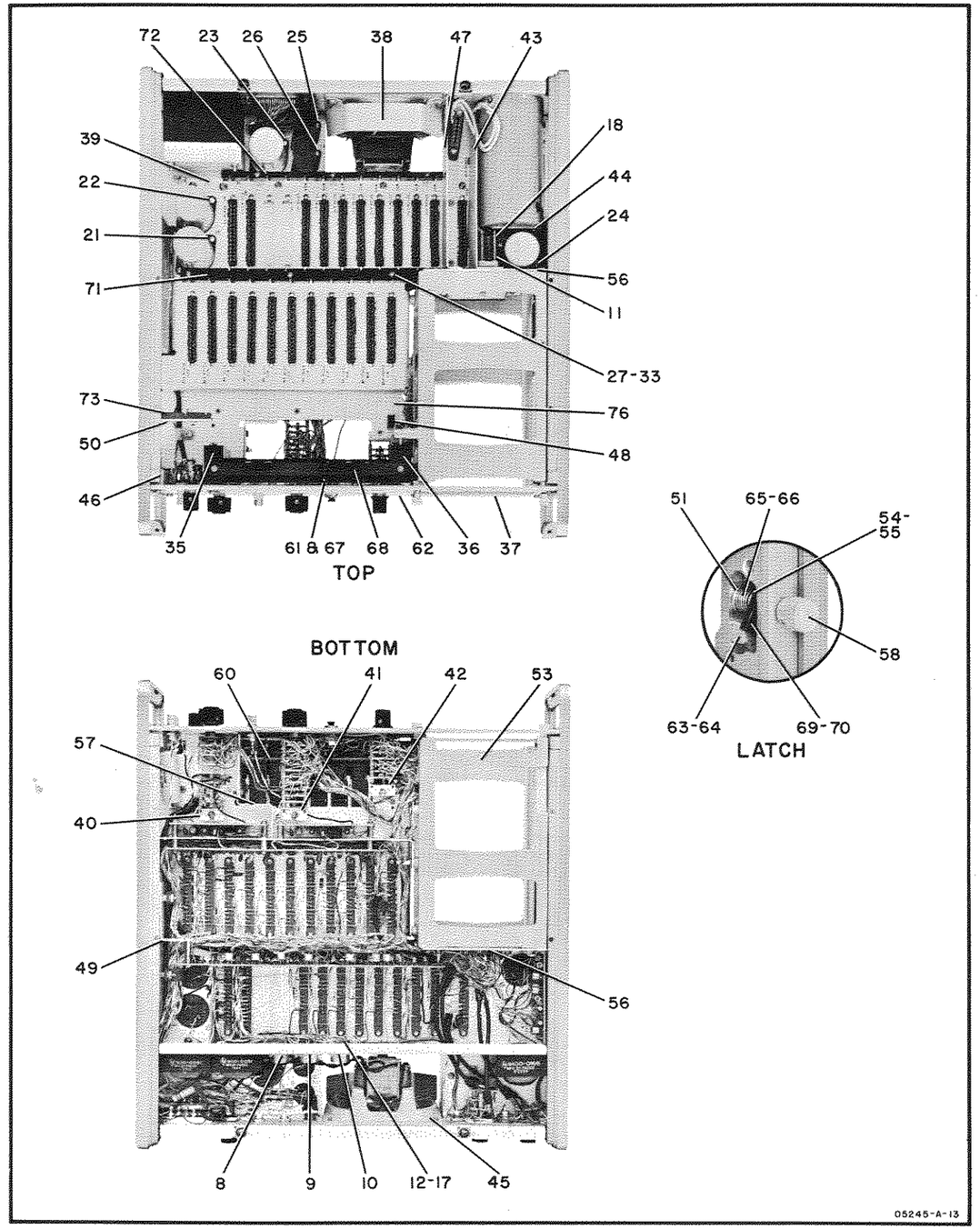

Figure 5-45. Mechanical Parts Locations

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts. Table 6-1 lists parts in alpha-numerical order of their reference designators and indicates the description and hp stock number of each part, together with any applicable notes. Table 6-2 lists parts in alpha-numerical order of their hp stock numbers and provides the following information on each part:

a. Description of the part (see list of abbreviations below).

b. Typical manufacturer of the part in a five-digit code; see list of manufacturers in Table 6-3.

c. Manufacturer's stock number.

d. Total quantity used in the instrument (TQ column).

6-3. Miscellaneous parts are listed in alphabetical order of their description at the end of Table 6-1.

6-4. ORDERING INFORMATION.

6-5. To order a replacement part, address order or inquiry to your local Hewlett-Packard field office (see map at rear of this manual for addresses).

6-6. Specify the following information for each part:

a. Model and complete serial number of instrument.

b. Hewlett-Packard stock number.

c. Circuit reference designator.

d. Description.

6-7. To order a part not listed in the tables, give a complete description of the part and include its function and location.

REFERENCE DESIGNATORS

A	= assembly	F	= fuse	P	= plug	V	= vacuum tube, neon bulb, photocell, etc.
B	= motor	FL	= filter	Q	= transistor	W	= cable
C	= capacitor	J	= jack	R	= resistor	X	= socket
CR	= diode	K	= relay	RT	= thermistor	Y	= crystal
DL	= delay line	L	= inductor	S	= switch	Z	= network
DS	= device signaling (lamp)	M	= meter	T	= transformer		
E	= misc electronic part	MP	= mechanical part				

ABBREVIATIONS

A	= amperes	ELECT	= electrolytic	MOM	= momentary	RH	= round head
A.F.C	= automatic frequency control	ENCAP	= encapsulated	MTG	= mounting	RMO	= rack mount only
AMP	= amplifier			MY	= mylar	RMS	= root-mean-square
		F	= farads			ROT	= rotary
B.F.O.	= beat frequency oscillator	FH	= flat head	NC	= normally closed		
BE CU	= beryllium copper	FIL H	= fillister head	NE	= neon	S-B	= slow-blow
BH	= binder head	FXD	= fixed	NI PL	= nickel plate	SE	= selenium
BP	= bandpass			NO	= normally open	SECT	= section(s)
BRS	= brass	GE	= germanium	NPO	= negative positive zero (zero temperature coefficient)	SEMICON	= semiconductor
BWO	= backward wave oscillator	GL	= glass			SI	= silicon
		GRD	= ground(ed)	NSR	= not separately replaceable	SIL	= silver
CER	= ceramic					SL	= slide
CMO	= cabinet mount only	H	= henries			SPL	= special
COEF	= coefficient	HEX	= hexagonal	OBD	= order by description	SST	= stainless steel
COM	= common	HG	= mercury	OH	= oven head		
COMP	= composition	HR	= hour(s)	OX	= oxide	TA	= tantalum
CONN	= connector					TD	= time delay
CP	= cadmium plate	IMPG	= impregnated	P	= peak	TI	= titanium
CRT	= cathode-ray tube	INCD	= incandescent	PC	= printed circuit board	TOG	= toggle
		INS	= insulation(ed)	PF	= picofarads = 10^{-12} farads	TOL	= tolerance
DEPC	= deposited carbon					TRIM	= trimmer
		K	= kilo = 1000	PH BRZ	= phosphor bronze	TWT	= traveling wave tube
EIA	= Tubes or transistors meeting Electronic Industries' Association standards will normally result in instrument operating within specifications; tubes and transistors selected for best performance will be supplied if ordered by hp stock numbers.	LIN	= linear taper	PIV	= peak inverse voltage	U	= micro = 10^{-6}
		LK	= lock	POLY	= polystyrene		
		LOG	= logarithmic taper	POR	= porcelain	VAC	= vacuum
		LPF	= low pass filter	POS	= position(s)	VAR	= variable
				POT	= potentiometer		
		M	= milli = 10^{-3}	PP	= peak-to-peak	W	= watts
		MEG	= meg = 10^{6}	PT	= point	W/	= with
		METFLM	= metal film			W/O	= without
		MFR	= manufacturer	RECT	= rectifier	WW	= wirewound
		MINAT	= miniature	RF	= radio frequency		

01194-8

Table 6-1. Reference Designation Index

Reference Designation	℗ Stock No.	Description #	Note
A1	5245L-19C	ASSY:PANEL SWITCH	
A1C1	0121-0039	C:VAR CER 8-50PF 350WVDC	
A1C2	0130-0018	C:VAR CER 1.5-7 PF 500 VDCW	
A1CR1	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A1CR2	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A1CR3	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A1CR4	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A1CR5	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A1R1	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A1R2	0683-9135	R:FXD COMP 91K OHMS 5% 1/4W	
A1R3		NOT ASSIGNED	
A1R4	0683-2245	R:FXD COMP 220K OHM 5% 1/4W	
A1S1	3100-0380	SWITCH:ROT 5-SECT 5-POS	
A2		NSR:PART OF A 1	
A3		NSR:PART OF A 1	
A3R1	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A3R2	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A3S1	3100-0315	SWITCH:ROTARY 6 SECT 10 POS	
A4	5245L-19B	ASSY:MODE SWITCH	
A4C1	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A4R1	0683-1025	R:FXD:COMP 1000 OHMS 5% 1/4W	
A4S1	3100-0389	SWITCH:ROT 1-SECT 3-POS HP SPEC	
A5	5245L-19A	ASSY:OUTPUT SWITCH	
A5C1	0170-0094	C:FXD MY 0.047UF 20% 50VDCW	
A5C2	0170-0094	C:FXD MY 0.047UF 20% 50VDCW	
A5CR1	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A5Q1	1850-0062	TRANSISTOR:GERMANIUM	
A5R1	0683-3315	R:FXD COMP 330 OHMS 5% 1/4W	
A5R2	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
A5R3	0683-1025	R:FXD:COMP 1000 OHMS 5% 1/4W	
A5R4	0683-1025	R:FXD:COMP 1000 OHMS 5% 1/4W	
A5R5	0683-6225	R:FXD COMP 6200 OHMS 5% 1/4W	
A5S1	3100-0390	SWITCH:ROT 2-SECT 9-POS HP SPEC	
A6	5243A-65L	ASSY:RECTIFIER	
	5243A-65L-1	BOARD:BLANK P.C.	
A6CR1	1901-0045	SEMICON DEVICE:DIODE SI	
A6CR2	1901-0045	SEMICON DEVICE:DIODE SI	
A6CR3	1901-0045	SEMICON DEVICE:DIODE SI	
A6CR4	1901-0045	SEMICON DEVICE:DIODE SI	
A6CR5	1901-0045	SEMICON DEVICE:DIODE SI	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

Reference Designation	Stock No.	Description #	Note
A6CR6	1901-0045	SEMICON DEVICE:DIODE SI	
A6CR7	1901-0029	SEMICON DEVICE:DIODE SI 600V	
A6CR8	1901-0029	SEMICON DEVICE:DIODE SI 600V	
A6CR9	1901-0045	SEMICON DEVICE:DIODE SI	
A6CR10	1901-0045	SEMICON DEVICE:DIODE SI	
A6CR11	1901-0045	SEMICON DEVICE:DIODE SI	
A6CR12	1901-0045	SEMICON DEVICE:DIODE SI	
A6CR13	1901-0049	SEMICON DEVICE:DIODE SI	
A6CR14	1901-0049	SEMICON DEVICE:DIODE SI	
A6CR15	1901-0049	SEMICON DEVICE:DIODE SI	
A6CR16	1901-0049	SEMICON DEVICE:DIODE SI	
A7	5243A-65H	ASSY:REGULATOR	
	5243A-65H-1	BOARD:BLANK P.C.	
A7C1	0170-0040	C:FXD MY .047 UF 10% 200VDCW	
A7C2	0180-0058	C:FXD ELECT 50UF -10%+100% 25VDCW	
A7C3	0170-0040	C:FXD MY .047 UF 10% 200VDCW	
A7C4	0180-0058	C:FXD ELECT 50UF -10%+100% 25VDCW	
A7C5	0180-0039	C:FXD ELECT 100UF 12VDCW	
A7CR1	1902-0017	SEMICON DEVICE:DIODE SI	
A7CR2	1902-0124	SEMICON DEVICE:DIODE BREAKDOWN	
A7CR3	1902-0017	SEMICON DEVICE:DIODE SI	
A7CR4	1902-0057	SEMICON DEVICE:DIODE SILICON	
A7Q1	1853-0001	TRANSISTOR:PNP SILICON 30V 900MW	
A7Q2	1850-0062	TRANSISTOR:GERMANIUM	
A7Q3	1853-0001	TRANSISTOR:PNP SILICON 30V 900MW	
A7Q4	1850-0062	TRANSISTOR:GERMANIUM	
A7Q5	1850-0048	TRANSISTOR:GERMANIUM 2N650 PNP	
A7R1	0758-0015	R:FXD MET FLM 220 OHMS 5% 1/2W	
A7R2	0686-1025	R:FXD COMP 1000 OHM 5% 1/2W	
A7R3	0686-2235	R:FXD COMP 22K OHM 5% 1/2W	
A7R4	0758-0015	R:FXD MET FLM 220 OHMS 5% 1/2W	
A7R5	2100-0323	R:VAR COMP 500 OHM 20% LIN 1/3W	
A7R6	0758-0015	R:FXD MET FLM 220 OHMS 5% 1/2W	
A7R7	0689 2035	R:FXD COMP 20K OHM 5% 1W	
A7R8	0758-0015	R:FXD MET FLM 220 OHMS 5% 1/2W	
A7R9	0686-8215	R:FXD COMP 820 OHM 5% 1/2W	
A7R10	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
A7R11	0758-0015	R:FXD MET FLM 220 OHMS 5% 1/2W	
A7R12	2100-0323	R:VAR COMP 500 OHM 20% LIN 1/3W	
A7R13	0758-0028	R:FXD MET FLM 270 OHMS 5% 1/2W	
A7R14	0686-8215	R:FXD COMP 820 OHM 5% 1/2W	
A7R15	0686-2735	R:FXD COMP 27K OHM 5% 1/2W	
A7R16	0686-6215	R:FXD COMP 620 OHM 5% 1/2W	
A7R17	2100-0323	R:VAR COMP 500 OHM 20% LIN 1/3W	
A7R18	0686-1225	R:FXD COMP 1200 OHM 5% 1/2W	
A7R19	0686-3625	R:FXD COMP 3600 OHM 5% 1/2W	
A7R20	0683-3615	R:FXD COMP 360 OHM 5% 1/4W	
A8	5243L-65A	ASSY:DECIMAL POINT	
A8CR1	1901-0025	SEMICON DEVICE:DIODE JUNCTION	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

Reference Designation	℗ Stock No.	Description #	Note
A8CR2	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A8CR3	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A8CR4	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A8CR5	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A8CR6	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A8CR7	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A8CR8	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A8CR9	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A8CR10	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A8CR11	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A8CR12	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A8CR13	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A8CR14	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A8CR15	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A8CR16	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A8CR17	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A8CR18	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A8R1	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A8R2	0683-6835	R:FXD COMP 68K OHM 5% 1/4W	
A8R3	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A8R4	0683-6835	R:FXD COMP 68K OHM 5% 1/4W	
A8R5	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A8R6	0683-6835	R:FXD COMP 68K OHM 5% 1/4W	
A8R7	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A8R8	0683-6835	R:FXD COMP 68K OHM 5% 1/4W	
A8R9	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A8R10	0683-6835	R:FXD COMP 68K OHM 5% 1/4W	
A8R11	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A8R12	0683-6835	R:FXD COMP 68K OHM 5% 1/4W	
A8R13	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A8R14	0683-6835	R:FXD COMP 68K OHM 5% 1/4W	
A8R15	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A8R16	0683-6835	R:FXD COMP 68K OHM 5% 1/4W	
A8R17	0683-1245	R:FXD COMP 120K OHM 5% 1/4W	
A8R18	0683-1245	R:FXD COMP 120K OHM 5% 1/4W	
A8R19	0683-1245	R:FXD COMP 120K OHM 5% 1/4W	
A8R20	0683-1245	R:FXD COMP 120K OHM 5% 1/4W	
A9	5243L-65B	ASSY:MEASUREMENT UNITS	
	5243L-65B-1	BOARD:BLANK P.C.	
A9C1	0150-0012	C:FXD CER 0.01UF 20% 1000VDCW	
A9CR1	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9CR2	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9CR3	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9CR4	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9CR5	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9CR6	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9CR7	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9CR8	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9CR9	1901-0025	SEMICON DEVICE:DIODE JUNCTION	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	℗ Stock No.	Description #	Note
A9CR10	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9CR11	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9CR12	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9DS10	2140-0015	LAMP:GLOW NEON NE-2H	
A9DS11	2140-0015	LAMP:GLOW NEON NE-2H	
A9DS12	2140-0015	LAMP:GLOW NEON NE-2H	
A9DS13	2140-0015	LAMP:GLOW NEON NE-2H	
A9DS14	2140-0015	LAMP:GLOW NEON NE-2H	
A9DS15	2140-0015	LAMP:GLOW NEON NE-2H	
A9R1	0683-5135	R:FXD COMP 51K OHMS 5% 1/4W	
A9R2	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A9R3	0683-5135	R:FXD COMP 51K OHMS 5% 1/4W	
A9R4	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A9R5	0683-5135	R:FXD COMP 51K OHMS 5% 1/4W	
A9R6	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A9R7	0683-5135	R:FXD COMP 51K OHMS 5% 1/4W	
A9R8	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A9R9	0683-5135	R:FXD COMP 51K OHMS 5% 1/4W	
A9R10	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A9R11	0683-5135	R:FXD COMP 51K OHMS 5% 1/4W	
A9R12	0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	
A9R13	0683-1245	R:FXD COMP 120K OHM 5% 1/4W	
A9R14	0683-1245	R:FXD COMP 120K OHM 5% 1/4W	
A9R15	0683-1245	R:FXD COMP 120K OHM 5% 1/4W	
A9R16	0683-1245	R:FXD COMP 120K OHM 5% 1/4W	
A10	5212L-4A	ASSY:DECIMAL COUNTER	
	5212L-4A-1	BLANK BOARD P.C.	
A10C1	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
A10C2	0140-0217	C:FXD MICA 140 PF 2% 300VDCW	
A10C3	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
A10C4	0140-0195	C:FXD MICA 130 PF 5% 300 VDCW	
A10C5	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
A10C6	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
A10C7	0140-0198	C:FXD MICA 200PF 5% 300VDCW	
A10C8	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
A10C9	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
A10C10	0140-0195	C:FXD MICA 130 PF 5% 300 VDCW	
A10C11	0140-0198	C:FXD MICA 200PF 5% 300VDCW	
A10C12	0140-0198	C:FXD MICA 200PF 5% 300VDCW	
A10C13	0140-0199	C:FXD MICA 240PF 5% 300VDCW	
A10CR1	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A10CR2	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A10CR3	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A10CR4	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A10CR5	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A10CR6	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A10CR7	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A10CR8	1901-0025	SEMICON DEVICE:DIODE JUNCTION	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	℗ Stock No.	Description #	Note
A10CR9	1910-0015	SEMICON DEVICE:DIODE GERMANIUM	
A10CR10	1910-0015	SEMICON DEVICE:DIODE GERMANIUM	
A10CR11	1910-0015	SEMICON DEVICE:DIODE GERMANIUM	
A10CR12	1910-0015	SEMICON DEVICE:DIODE GERMANIUM	
A10CR13	1910-0015	SEMICON DEVICE:DIODE GERMANIUM	
A10DS1	2140-0044	LAMP:NEON SELECTED MATCHED PAIR(N.R.F.R.)	
A10DS2	2140-0044	LAMP:NEON SELECTED MATCHED PAIR(N.R.F.R.)	
A10DS3	2140-0044	LAMP:NEON SELECTED MATCHED PAIR(N.R.F.R.)	
A10DS4	2140-0044	LAMP:NEON SELECTED MATCHED PAIR(N.R.F.R.)	
A10DS5		NOT ASSIGNED	
A10DS6	1970-0009	ELECTRON TUBE:INDICATOR 10 DIGIT	
A10MP1	0905-0043	GASKET:PHOTOCONDUCTOR NOT RECOMMENDED FOR FIELD REPLACEMENT	
A10MP2	0905-0051	GASKET:FELT NOT RECOMMENDED FOR FIELD REPLACEMENT	
A10MP3	5212A-83C	COVER:COLUMN NOT RECOMMENDED FOR FIELD REPLACEMENT	
A10MP4	5212A-83H	BLOCK:PHOTOCONDUCTOR NOT RECOMMENDED FOR FIELD REPLACEMENT	
A10MP5	5212L-83C	READOUT:IN-LINE NOT RECOMMENDED FOR FIELD REPLACEMENT	
A10Q1	1850-0062	TRANSISTOR:GERMANIUM	
A10Q2	1850-0062	TRANSISTOR:GERMANIUM	
A10Q3	1850-0062	TRANSISTOR:GERMANIUM	
A10Q4	1850-0062	TRANSISTOR:GERMANIUM	
A10Q5	1850-0062	TRANSISTOR:GERMANIUM	
A10Q6	1850-0062	TRANSISTOR:GERMANIUM	
A10Q7	1850-0062	TRANSISTOR:GERMANIUM	
A10Q8	1850-0062	TRANSISTOR:GERMANIUM	
A10R1	0686-4735	R:FXD COMP 47K OHM 5% 1/2W	
A10R2	0845-0001	NETWORK:RESISTIVE(10 RESISTORS) N.R.F.R.	
A10R3 THRU			
A10R5		NOT ASSIGNED	
A10R6	0683-3945	R:FXD COMP 390K OHMS 5% 1/4W	
A10R7	0683-3945	R:FXD COMP 390K OHMS 5% 1/4W	
A10R8	0683-3945	R:FXD COMP 390K OHMS 5% 1/4W	
A10R9	0683-3945	R:FXD COMP 390K OHMS 5% 1/4W	
A10R10	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A10R11	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A10R12	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A10R13	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A10R14	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A10R15	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A10R16	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A10R17	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A10R18	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
A10R19	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
A10R20	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A10R21	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
A10R22	0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	
A10R23	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	Stock No.	Description #	Note
A10R24	0683-1815	R:FXD COMP 180 OHM 5% 1/4W	
A10R25	0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	
A10R26	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
A10R27	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
A10R28	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A10R29	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
A10R30	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
A10R31	0683-8225	R:FXD COMP 8200 OHMS 5% 1/4W	
A10R32	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
A10R33	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A10R34	0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	
A10R35	0683-1815	R:FXD COMP 180 OHM 5% 1/4W	
A10R36	0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	
A10R37	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
A10R38	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
A10R39	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A10R40	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
A10R41	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
A10R42	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A10R43	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
A10R44	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A10R45	0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	
A10R46	0683-1815	R:FXD COMP 180 OHM 5% 1/4W	
A10R47	0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	
A10R48	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
A10R49	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
A10R50	0683-8225	R:FXD COMP 8200 OHMS 5% 1/4W	
A10R51	0683-6835	R:FXD COMP 68K OHM 5% 1/4W	
A10R52	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
A10R53	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
A10R54	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A10R55	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
A10R56	0686 4735	R:FXD COMP 47K OHM 5% 1/2W	
A10R57	0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	
A10R58	0683-1815	R:FXD COMP 180 OHM 5% 1/4W	
A10R59	0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	
A10R60	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
A10R61	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
A10R62	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A10V1	1990-0009	PLATE:PHOTOCONDUCTOR (N.R.F.R.)	
A11	5212L-4A	ASSY:DECIMAL COUNTER SAME AS A10; USE PREFIX A11	
A12	5212L-4A	ASSY:DECIMAL COUNTER SAME AS A10; USE PREFIX A12	
A13	5212L-4A	ASSY:DECIMAL COUNTER SAME AS A10; USE PREFIX A13	
A14	5212L-4A	ASSY:DECIMAL COUNTER SAME AS A10; USE PREFIX A14	
A15	5232L-4B	ASSY:DECIMAL COUNTER	
	5232A-65G-1	BLANK BOARD:PRINTED CIRCUIT	
A15C1	0140-0191	C:FXD MICA 56 PF 5% 300 VDCW	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	Stock No.	Description #	Note
A15C2	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
A15C3	0150-0122	C:FXD CER 2000PF 20% 500VDCW	
A15C4	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
A15C5	0160-0179	C:FXD MICA 33PF 5% 300VDCW	
A15C6	0140-0190	C:FXD MICA 39 PF 5% 300 VDCW	
A15C7	0150-0122	C:FXD CER 2000PF 20% 500VDCW	
A15C8	0140-0190	C:FXD MICA 39 PF 5% 300 VDCW	
A15C9	0140-0190	C:FXD MICA 39 PF 5% 300 VDCW	
A15C10	0140-0204	C:FXD MICA 47PF 5% NPO 500VDCW	
A15C11		NOT ASSIGNED	
A15C12	0140-0204	C:FXD MICA 47PF 5% NPO 500VDCW	
A15C13	0140-0205	C:FXD MICA 62PF 5% 300VDCW	
A15C14	0140-0204	C:FXD MICA 47PF 5% NPO 500VDCW	
A15C15	0140-0192	C:FXD MICA 68PF 5% 300VDCW	
A15C16	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
A15C17	0140-0193	C:FXD MICA 82 PF 5% 300 VDCW	
A15CR1	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A15CR2	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A15CR3	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A15CR4	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A15CR5	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A15CR6	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A15CR7	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A15CR8	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A15CR9	1910-0021	SEMICON DEVICE:DIODE	
A15CR10	1901-0040	SEMICON DEVICE:DIODE SILICON	
A15CR11	1910-0021	SEMICON DEVICE:DIODE	
A15CR12	1910-0021	SEMICON DEVICE:DIODE	
A15CR13	1910-0021	SEMICON DEVICE:DIODE	
A15CR14	1901-0040	SEMICON DEVICE:DIODE SILICON	
A15CR15	1910-0021	SEMICON DEVICE:DIODE	
A15CR16	1910-0021	SEMICON DEVICE:DIODE	
A15CR17	1910-0021	SEMICON DEVICE:DIODE	
A15CR18	1910-0021	SEMICON DEVICE:DIODE	
A15CR19	1910-0021	SEMICON DEVICE:DIODE	
A15CR20	1910-0021	SEMICON DEVICE:DIODE	
A15DS1	2140-0044	LAMP:NEON SELECTED MATCHED PAIR (N.R.F.R.)	
A15DS2	2140-0044	LAMP:NEON SELECTED MATCHED PAIR (N.R.F.R.)	
A15DS3	2140-0044	LAMP:NEON SELECTED MATCHED PAIR (N.R.F.R.)	
A15DS4	2140-0044	LAMP:NEON SELECTED MATCHED PAIR (N.R.F.R.)	
A15DS5		NOT ASSIGNED	
A15DS6	1970-0009	ELECTRON TUBE INDICATOR 10 DIGIT	
A15MP1	0905-0043	GASKET:PHOTOCONDUCTOR NOT RECOMMENDED FOR FIELD REPLACEMENT	
A15MP2	0905-0051	GASKET:FELT NOT RECOMMENDED FOR FIELD REPLACEMENT	
A15MP3	5212A-83C	COVER:COLUMN NOT RECOMMENDED FOR FIELD REPLACEMENT	
A15MP4	5212A-83H	BLOCK:PHOTOCONDUCTOR NOT RECOMMENDED FOR FIELD REPLACEMENT	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	℗ Stock No.	Description #	Note
A15MP5	5212L-83C	READOUT:IN-LINE NOT RECOMMENDED FOR FIELD REPLACEMENT	
A15Q1	1850-0105	TRANSISTOR-GERMANIUM PNP SPL 2N2048	
A15Q2	1850-0105	TRANSISTOR-GERMANIUM PNP SPL 2N2048	
A15Q3	1850-0105	TRANSISTOR-GERMANIUM PNP SPL 2N2048	
A15Q4	1850-0105	TRANSISTOR-GERMANIUM PNP SPL 2N2048	
A15Q5	1850-0105	TRANSISTOR-GERMANIUM PNP SPL 2N2048	
A15Q6	1850-0105	TRANSISTOR-GERMANIUM PNP SPL 2N2048	
A15Q7	1850-0105	TRANSISTOR-GERMANIUM PNP SPL 2N2048	
A15Q8	1850-0105	TRANSISTOR-GERMANIUM PNP SPL 2N2048	
A15R1	0686-4735	R:FXD COMP 47K OHM 5% 1/2W	
A15R2	0845-0001	NETWORK:RESISTIVE(10 RESISTORS)	
A15R3 THRU A15R5		NOT ASSIGNED	
A15R6	0683-3945	R:FXD COMP 390K OHM 5% 1/4W	
A15R7	0683-3945	R:FXD COMP 390K OHM 5% 1/4W	
A15R8	0683-3945	R:FXD COMP 390K OHM 5% 1/4W	
A15R9	0683-3945	R:FXD COMP 390K OHM 5% 1/4W	
A15R10	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
A15R11	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
A15R12	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
A15R13	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
A15R14	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
A15R15	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
A15R16	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
A15R17	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
A15R18	0758-0043	R:FXD MET FLM 1800 OHM 5% 1/2W	
A15R19	0683-1635	R:FXD COMP 16K OHM 5% 1/4W	
A15R20	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A15R21	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
A15R22	0683-4705	R:FXD COMP 47 OHM 5% 1/4W	
A15R23	0683-1835	R:FXD COMP 18K OHM 5% 1/4W	
A15R24	0683-5605	R:FXD COMP 56 OHM 5% 1/4W	
A15R25	0683-2705	R:FXD COMP 27 OHM 5% 1/4W	
A15R26	0758-0043	R:FXD MET FLM 1800 OHM 5% 1/2W	
A15R27	0683-1635	R:FXD COMP 16K OHM 5% 1/4W	
A15R28	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A15R29	0758-0043	R:FXD MET FLM 1800 OHM 5% 1/2W	
A15R30	0683-1635	R:FXD COMP 16K OHM 5% 1/4W	
A15R31	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A15R32	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
A15R33	0683-1835	R:FXD COMP 18K OHM 5% 1/4W	
A15R34	0683-4705	R:FXD COMP 47 OHM 5% 1/4W	
A15R35	0683-5605	R:FXD COMP 56 OHM 5% 1/4W	
A15R36	0758-0043	R:FXD MET FLM 1800 OHM 5% 1/2W	
A15R37	0683-1635	R:FXD COMP 16K OHM 5% 1/4W	
A15R38	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A15R39	0758-0004	R:FXD MET FLM 2700 OHM 5% 1/2W	
A15R40	0683-1835	R:FXD COMP 18K OHM 5% 1/4W	
A15R41	0683-1825	R:FXD COMP 1800 OHM 5% 1/4W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

Reference Designation	Stock No.	Description #	Note
A15R42	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
A15R43	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
A15R44	0683-2705	R:FXD COMP 27 OHM 5% 1/4W	
A15R45	0683-7505	R:FXD COMP 75 OHM 5% 1/4W	
A15R46	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A15R47	0683-2705	R:FXD COMP 27 OHM 5% 1/4W	
A15R48	0758-0004	R:FXD MET FLM 2700 OHM 5% 1/2W	
A15R49	0683-1835	R:FXD COMP 18K OHM 5% 1/4W	
A15R50	0683-1825	R:FXD COMP 1800 OHM 5% 1/4W	
A15R51	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
A15R52	0683-3025	R:FXD COMP 3000 OHM 5% 1/4W	
A15R53	0758-0004	R:FXD MET FLM 2700 OHM 5% 1/2W	
A15R54	0683-1835	R:FXD COMP 18K OHM 5% 1/4W	
A15R55	0683-1825	R:FXD COMP 1800 OHM 5% 1/4W	
A15R56	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
A15R57	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
A15R58	0683-7505	R:FXD COMP 75 OHM 5% 1/4W	
A15R59	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A15R60	0758-0004	R:FXD MET FLM 2700 OHM 5% 1/2W	
A15R61	0683-1835	R:FXD COMP 18K OHM 5% 1/4W	
A15R62	0683-1825	R:FXD COMP 1800 OHM 5% 1/4W	
A15R63	0683-2705	R:FXD COMP 27 OHM 5% 1/4W	
A15R64	0683-9115	R:FXD COMP 910 OHM 5% 1/4W	
A15V1	1990-0009	PLATE:PHOTOCONDUCTOR (N.R.F.R.)	
A16	5232L-48	ASSY:DECIMAL COUNTER SAME AS A15, USE PREFIX A16	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	Stock No.	Description #	Note
A17	5245A-65C	ASSY:DECIMAL COUNTER	
	5245A-65C-1	BOARD:BLANK P.C.	
A17C1	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A17C2	0150-0050	C:FXD CER 100 PF 600 VDCW	
A17C3	0140-0196	C:FXD MICA 150 PF 5% 300 VDCW	
A17C4	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
A17C5	0140-0210	C:FXD MICA 270PF 5% 300VDCW	
A17C6	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
A17C7	0140-0196	C:FXD MICA 150 PF 5% 300 VDCW	
A17C8	0140-0202	C:FXD MICA 15 PF 5% 500VDCW	
A17C9	0140-0208	C:FXD MICA 680PF 5% 300VDCW	
A17C10	0140-0202	C:FXD MICA 15 PF 5% 500VDCW	
A17C11	0140-0204	C:FXD MICA 47PF 5% NPO 500VDCW	
A17C12	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
A17C13	0140-0214	C:FXD MICA 60PF 5% 300VDCW	
A17C14	0140-0210	C:FXD MICA 270PF 5% 300VDCW	
A17C15	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
A17C16	0140-0214	C:FXD MICA 60PF 5% 300VDCW	
A17C17	0140-0203	C:FXD MICA 30PF 5% 500VDCW	
A17C18	0140-0202	C:FXD MICA 15 PF 5% 500VDCW	
A17C19	0140-0210	C:FXD MICA 270PF 5% 300VDCW	
A17C20	0140-0202	C:FXD MICA 15 PF 5% 500VDCW	
A17C21	0140-0193	C:FXD MICA 82PF 5% 300VDCW	
A17C22	0140-0200	C:FXD MICA 390PF 5% 300VDCW	
A17C23	0140-0200	C:FXD MICA 390PF 5% 300VDCW	
A17C24	0140-0200	C:FXD MICA 390PF 5% 300VDCW	
A17C25	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A17C26	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A17C27	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A17C28	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A17C29	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A17CR1	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	
A17CR2	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	
A17CR3	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	
A17CR4	1910-0021	SEMICON DEVICE:DIODE	
A17CR5	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	
A17CR6	1910-0021	SEMICON DEVICE:DIODE	
A17CR7	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	
A17CR8	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	
A17CR9	1910-0021	SEMICON DEVICE:DIODE	
A17CR10	1910-0021	SEMICON DEVICE:DIODE	
A17CR11	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	
A17CR12	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	
A17CR13	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	
A17CR14	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	
A17CR15	1910-0021	SEMICON DEVICE:DIODE	
A17CR16	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	
A17CR17	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	℗ Stock No.	Description #	Note
A17CR18	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	
A17CR19	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	
A17CR20	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A17L1	9140-0159	COIL:FXD 0.47UH 20%	
A17L2	9140-0158	COIL:FXD 1.0UH 10%	
A17L3	9140-0159	COIL:FXD 0.47UH 20%	
A17L4	9140-0158	COIL:FXD 1.0UH 10%	
A17L5	9140-0143	COIL:FXD RF 3.3 UH	
A17L6	9140-0159	COIL:FXD 0.47UH 20%	
A17L7	9140-0159	COIL:FXD 0.47UH 20%	
A17L8	9140-0143	COIL:FXD RF 3.3 UH	
A17L9	9140-0143	COIL:FXD RF 3.3 UH	
A17Q1	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A17Q2	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A17Q3	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A17Q4	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A17Q5	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A17Q6	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A17Q7	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A17Q8	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A17Q9	1850-0102	TRANSISTOR:GE2N2455	
A17Q10	1850-0102	TRANSISTOR:GE2N2455	
A17Q11	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A17Q12	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A17Q13	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A17R1	0683-5115	R:FXD COMP 510 OHMS 5% 1/4W	
A17R2	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A17R3	0683-2015	R:FXD COMP 200 OHMS 5% 1/4W	
A17R4	0683-1225	R:FXD COMP 1200 OHMS 5% 1/4W	
A17R5	0683-3315	R:FXD COMP 330 OHMS 5% 1/4W	
A17R6	0683-2025	R:FXD COMP 2000 OHMS 5% 1/4W	
A17R7	0683-3305	R:FXD COMP 33 OHMS 5% 1/4W	
A17R8	0683-2025	R:FXD COMP 2000 OHMS 5% 1/4W	
A17R9	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A17R10	0683-2015	R:FXD COMP 200 OHMS 5% 1/4W	
A17R11	0683-1225	R:FXD COMP 1200 OHMS 5% 1/4W	
A17R12	0683-3315	R:FXD COMP 330 OHMS 5% 1/4W	
A17R13	0683-2025	R:FXD COMP 2000 OHMS 5% 1/4W	
A17R14	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A17R15	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A17R16	0683-3315	R:FXD COMP 330 OHMS 5% 1/4W	
A17R17	0683-1825	R:FXD COMP 1800 OHMS 5% 1/4W	
A17R18	0683-2725	R:FXD COMP 2700 OHMS 5% 1/4W	
A17R19	0683-5105	R:FXD COMP 51 OHM 5% 1/4W	
A17R20	0683-2415	R:FXD COMP 240 OHMS 5% 1/4W	
A17R21	0683-1825	R:FXD COMP 1800 OHMS 5% 1/4W	
A17R22	0683-2725	R:FXD COMP 2700 OHMS 5% 1/4W	
A17R23	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A17R24	0683-2025	R:FXD COMP 2000 OHMS 5% 1/4W	
A17R25	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	ℌ Stock No.	Description #	Note
A17R26	0683-2215	R:FXD COMP 220 OHMS 5% 1/4W	
A17R27	0683-1015	R:FXD COMP 100 OHMS 5% 1/4W	
A17R28	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	
A17R29	0683-2415	R:FXD COMP 240 OHMS 5% 1/4W	
A17R30	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A17R31	0683-8215	R:FXD COMP 820 OHMS 5% 1/4W	
A17R32	0683-3025	R:FXD COMP 3000 OHMS 5% 1/4W	
A17R33	0683-5105	R:FXD COMP 51 OHM 5% 1/4W	
A17R34	0683-2415	R:FXD COMP 240 OHMS 5% 1/4W	
A17R35	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A17R36	0683-8215	R:FXD COMP 820 OHMS 5% 1/4W	
A17R37	0683-3025	R:FXD COMP 3000 OHMS 5% 1/4W	
A17R38	0683-2025	R:FXD COMP 2000 OHMS 5% 1/4W	
A17R39	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A17R40	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	
A17R41	0683-3315	R:FXD COMP 330 OHMS 5% 1/4W	
A17R42	0683-1825	R:FXD COMP 1800 OHMS 5% 1/4W	
A17R43	0683-2725	R:FXD COMP 2700 OHMS 5% 1/4W	
A17R44	0683-5105	R:FXD COMP 51 OHM 5% 1/4W	
A17R45	0683-3315	R:FXD COMP 330 OHMS 5% 1/4W	
A17R46	0683-1825	R:FXD COMP 1800 OHMS 5% 1/4W	
A17R47	0683-2725	R:FXD COMP 2700 OHMS 5% 1/4W	
A17R48	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	
A17R49	0683-2025	R:FXD COMP 2000 OHMS 5% 1/4W	
A17R50	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A17R51	0686-4715	R:FXD COMP 470 OHMS 5% 1/2W	
A17R52	0683-5115	R:FXD COMP 510 OHM 5% 1/4W	
A17R53	0683-0475	R:FXD COMP 4.7 OHMS 5% 1/4W	
A17R54	0683-5615	R:FXD COMP 560 OHMS 5% 1/4W	
A17R55	0683-4315	R:FXD COMP 430 OHMS 5% 1/4W	
A17R56	0683-7515	R:FXD COMP 750 OHMS 5% 1/4W	
A17R57	0683-7515	R:FXD COMP 750 OHMS 5% 1/4W	
A17R58	0683-5115	R:FXD COMP 510 OHM 5% 1/4W	
A17R59	0683-7515	R:FXD COMP 750 OHMS 5% 1/4W	
A17R60	0761-0020	R:FXD MET FLM 91 OHM 5% 1W	
A17R61	0683-1015	R:FXD COMP 100 OHMS 5% 1/4W	
A17R62	0683-6805	R:FXD COMP 68 OHMS 5% 1/4W	
A18	5245L-48	ASSY:READOUT	
	5243A-65A-1	BOARD:BLANK P.C.	
A18CR1	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A18CR2	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A18CR3	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A18CR4	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A18CR5	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A18CR6	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A18CR7	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A18CR8	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A18DS1	2140-0044	LAMP:NEON SELECTED MATCHED PAIR (N.R.F.R.)	
A18DS2	2140-0044	LAMP:NEON SELECTED MATCHED PAIR (N.R.F.R.)	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	Stock No.	Description #	Note
A18DS3	2140-0044	LAMP:NEON SELECTED MATCHED PAIR(N.R.F.R.)	
A18DS4	2140-0044	LAMP:NEON SELECTED MATCHED PAIR(N.R.F.R.)	
A18DS5		NOT ASSIGNED	
A18DS6	1970-0009	ELECTRON TUBE:INDICATOR 10 DIGIT	
A18MP1	0905-0043	GASKET:PHOTOCONDUCTOR NOT RECOMMENDED FOR FIELD REPLACEMENT	
A18MP2	0905-0051	GASKET:FELT NOT RECOMMENDED FOR FIELD REPLACEMENT	
A18MP3	5212A-83C	COVER:COLUMN NOT RECOMMENDED FOR FIELD REPLACEMENT	
A18MP4	5212A-83H	BLOCK:PHOTOCONDUCTOR NOT RECOMMENDED FOR FIELD REPLACEMENT	
A18MP5	5212L-83C	READOUT:IN-LINE NOT RECOMMENDED FOR FIELD REPLACEMENT	
A18Q1	1854-0015	TRANSISTOR:SI NPN	
A18Q2	1854-0015	TRANSISTOR:SI NPN	
A18Q3	1854-0015	TRANSISTOR:SI NPN	
A18Q4	1854-0015	TRANSISTOR:SI NPN	
A18Q5	1854-0015	TRANSISTOR:SI NPN	
A18Q6	1854-0015	TRANSISTOR:SI NPN	
A18Q7	1854-0015	TRANSISTOR:SI NPN	
A18Q8	1854-0015	TRANSISTOR:SI NPN	
A18R1	0686 4735	R:FXD COMP 47K OHM 5% 1/2W	
A18R2	0845-0001	RESISTIVE NETWORK(10 RESISTOR)N.R.F.R.	
A18R5		NOT ASSIGNED	
A18R6	0683-3945	R:FXD COMP 390K OHMS 5% 1/4W	
A18R7	0683-3945	R:FXD COMP 390K OHMS 5% 1/4W	
A18R8	0683-3945	R:FXD COMP 390K OHMS 5% 1/4W	
A18R9	0683-3945	R:FXD COMP 390K OHMS 5% 1/4W	
A18R10	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A18R11	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A18R12	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A18R13	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A18R14	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A18R15	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A18R16	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A18R17	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A18R18	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A18R19	0683-7525	R:FXD COMP 7500 OHMS 5% 1/4W	
A18R20	0683-1545	R:FXD COMP 150K OHM 5% 1/4W	
A18R21	0683-5135	R:FXD COMP 51K OHM 5% 1/4W	
A18R22	0683-6805	R:FXD COMP 68 OHM 5% 1/4W	
A18R23		NOT ASSIGNED	
A18R24	0683-7525	R:FXD COMP 7500 OHMS 5% 1/4W	
A18R25	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
A18R26	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A18R27	0683-7525	R:FXD COMP 7500 OHMS 5% 1/4W	
A18R28	0683-1545	R:FXD COMP 150K OHM 5% 1/4W	
A18R29	0683-5135	R:FXD COMP 51K OHM 5% 1/4W	
A18R30	0683-9105	R:FXD COMP 910 OHM 5% 1/4W	
A18R31		NOT ASSIGNED	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	℗ Stock No.	Description #	Note
A18R32	0683-7525	R:FXD COMP 7500 OHMS 5% 1/4W	
A18R33	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
A18R34	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A18R35	0683-7525	R:FXD COMP 7500 OHMS 5% 1/4W	
A18R36	0683-1545	R:FXD COMP 150K OHM 5% 1/4W	
A18R37	0683-5135	R:FXD COMP 51K OHM 5% 1/4W	
A18R38	0683-9105	R:FXD COMP 910 OHM 5% 1/4W	
A18R39		NOT ASSIGNED	
A18R40	0683-7525	R:FXD COMP 7500 OHMS 5% 1/4W	
A18R41	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
A18R42	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A18R43	0683-7525	R:FXD COMP 7500 OHMS 5% 1/4W	
A18R44	0683-1545	R:FXD COMP 150K OHM 5% 1/4W	
A18R45	0683-5135	R:FXD COMP 51K OHM 5% 1/4W	
A18R46	0683-9105	R:FXD COMP 910 OHM 5% 1/4W	
A18R47		NOT ASSIGNED	
A18R48	0683-7525	R:FXD COMP 7500 OHMS 5% 1/4W	
A18R49	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
A18V1	1990-0009	PLATE:PHOTOCONDUCTOR(N.R.F.R.)	
A19	5245A-65M	ASSY:INPUT AMPLIFIER	
	5245A-65M-1	BOARD:BLANK P.C.	
A19C1	0140-0198	C:FXD MICA 200PF 5% 300VDCW	
A19C1	-	FACTORY SELECTED PART:TYPICAL VALUEGIVEN	
A19C2	0140-0178	C:FXD MICA 560 PF 2% 300 VDCW	
A19C3	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A19C4	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A19CR1	1901-0040	SEMICON DEVICE:DIODE SILICON	
A19CR2	1901-0040	SEMICON DEVICE:DIODE SILICON	
A19CR3	1901-0040	SEMICON DEVICE:DIODE SILICON	
A19L1	9140-0114	COIL:FXD RF 10 UH	
A19L2	9140-0114	COIL:FXD RF 10 UH	
A19Q1	1853-0003	TRANSISTOR:PNP SILICON	
A19Q2	1854-0018	TRANSISTOR:SILICON NPN 12V	
A19Q3	1850-0102	TRANSISTOR:2N2455	
A19R1	0766-0032	R:FXD MET FLM 835 OHMS 2% 3W	
A19R2	0683-2035	R:FXD COMP 20K OHMS 5% 1/4W	
A19R3	0683-1635	R:FXD COMP 16K OHMS 5% 1/4W	
A19R4	2100-0392	R:VAR WW LIN 2K OHM 10% 0.25W	
A19R5	0683-2435	R:FXD COMP 24K OHM 5% 1/4W	
A19R6	0683-6815	R:FXD COMP 680 OHMS 5% 1/4W	
A19R7	2100-0392	R:VAR WW LIN 2K OHM 10% 0.25W	
A19R8	0683-6805	R:FXD COMP 68 OHMS 5% 1/4W	
A19R9	0683-6225	R:FXD COMP 6200 OHMS 5% 1/4W	
A19R10	0683-6825	R:FXD COMP 6800 OHMS 5% 1/4W	
A19R11	0683-8215	R:FXD COMP 820 OHMS 5% 1/4W	
A19R12	0683-5115	R:FXD COMP 510 OHMS 5% 1/4W	
A19R13	0686-6215	R:FXD COMP 620 OHM 5% 1/2W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	ℌ Stock No.	Description #	Note
A20	5245A-65M	ASSY:INPUT AMPLIFIER	
	5245A-65M-1	BOARD:BLANK P.C.	
A20C1	0140-0198	C:FXD MICA 200PF 5% 300VDCW	
A20C1	-	FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A20C2	0140-0178	C:FXD MICA 560 PF 2% 300 VDCW	
A20C3	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A20C4	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A20CR1	1901-0040	SEMICON DEVICE:DIODE SILICON	
A20CR2	1901-0040	SEMICON DEVICE:DIODE SILICON	
A20CR3	1901-0040	SEMICON DEVICE:DIODE SILICON	
A20L1	9140-0114	COIL:FXD RF 10 UH	
A20L2	9140-0114	COIL:FXD RF 10 UH	
A20Q1	1853-0003	TRANSISTOR:PNP SILICON F 50MC MIN	
A20Q2	1854-0018	TRANSISTOR:SILICON NPN 12V	
A20Q3	1850-0102	TRANSISTOR:2N2455	
A20R1	0766-0032	R:FXD MET FLM 835 OHMS 2% 3W	
A20R2	0683-2035	R:FXD COMP 20K OHMS 5% 1/4W	
A20R3	0683-1635	R:FXD COMP 16K OHMS 5% 1/4W	
A20R4	2100-0392	R:VAR WW LIN 2K OHM 10% 0.25W	
A20R5	0683-2435	R:FXD COMP 24K OHM 5% 1/4W	
A20R6	0683-6815	R:FXD COMP 680 OHMS 5% 1/4W	
A20R7	2100-0392	R:VAR WW LIN 2K OHM 10% 0.25W	
A20R8	0683-6805	R:FXD COMP 68 OHMS 5% 1/4W	
A20R9	0683-6225	R:FXD COMP 6200 OHMS 5% 1/4W	
A20R10	0683-6825	R:FXD COMP 6800 OHMS 5% 1/4W	
A20R11	0683-8215	R:FXD COMP 820 OHMS 5% 1/4W	
A20R12	0683-5115	R:FXD COMP 510 OHMS 5% 1/4W	
A20R13	0686-6215	R:FXD COMP 620 OHM 5% 1/2W	
A21	5245A-65K	ASSY:FUNCTION CONTROL	
	5245A-65K-1	BOARD:BLANK P.C.	
A21C1	0140-0203	C:FXD MICA 30PF 5% 500VDCW	
A21C2	0140-0201	C:FXD MICA 12PF 5% 500VDCW	
A21C3	0170-0084	C:FXD MY 0.068UF 20% 50VDCW	
A21C4	0140-0203	C:FXD MICA 30PF 5% 500VDCW	
A21C5	0140-0149	C:FXD MICA 470 PF 5% 300 VDCW	
A21C6	0140-0149	C:FXD MICA 470 PF 5% 300 VDCW	
A21C7	0140-0203	C:FXD MICA 30PF 5% 500VDCW	
A21C8	0140-0149	C:FXD MICA 470 PF 5% 300 VDCW	
A21C9	0140-0149	C:FXD MICA 470 PF 5% 300 VDCW	
A21C10	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A21C11	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A21C12	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A21C13	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A21C14	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A21CR1	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A21CR2	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A21CR3	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A21CR4	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	℔ Stock No.	Description #	Note
A21CR5	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A21CR6	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A21CR7	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A21CR8	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A21CR9	1901-0040	SEMICON DEVICE:DIODE SILICON	
A21CR10	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A21CR11	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A21CR12	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A21CR13	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A21CR14	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A21CR15	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A21L1	9140-0141	COIL:FXD RF 0.68 UH	
A21L2	9140-0146	COIL:FXD RF 10.0 UH	
A21L3	9140-0146	COIL:FXD RF 10.0 UH	
A21Q1	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A21Q2	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A21Q3	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A21Q4	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A21Q5	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A21Q6	1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	
A21Q7	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A21Q8	1854-0009	TRANSISTOR:2N709 NPN SILICON	
A21Q9	1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	
A21Q10	1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	
A21Q11	1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	
A21Q12	1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	
A21Q13	1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	
A21R1	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A21R2	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A21R3	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A21R4	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A21R5	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A21R6	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A21R7	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A21R8	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A21R9	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A21R10	0683-2035	R:FXD COMP 20K OHMS 5% 1/4W	
A21R11	0683-4315	R:FXD COMP 430 OHMS 5% 1/4W	
A21R12	0683-2015	R:FXD COMP 200 OHMS 5% 1/4W	
A21R13	0683-5615	R:FXD COMP 560 OHMS 5% 1/4W	
A21R14	0683-6815	R:FXD COMP 680 OHMS 5% 1/4W	
A21R15	0683-3915	R:FXD COMP 390 OHMS 5% 1/4W	
A21R16	0683-2015	R:FXD COMP 200 OHMS 5% 1/4W	
A21R17	0683-1325	R:FXD COMP 1300 OHMS 5% 1/4W	
A21R18	0683-1015	R:FXD COMP 100 OHMS 5% 1/4W	
A21R19	0683-3915	R:FXD COMP 390 OHMS 5% 1/4W	
A21R20	0683-5105	R:FXD COMP 51 OHM 5% 1/4W	
A21R21	0683-5615	R:FXD COMP 560 OHMS 5% 1/4W	
A21R22	0683-1015	R:FXD COMP 100 OHMS 5% 1/4W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

Reference Designation	Stock No.	Description #	Note
A21R23	0683-9105	R:FXD COMP 910 OHM 5% 1/4W	
A21R24	0683-9105	R:FXD COMP 91 OHMS 5% 1/4W	
A21R25	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A21R26	0683-4315	R:FXD COMP 430 OHMS 5% 1/4W	
A21R27	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A21R28	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A21R29	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A21R30	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A21R31	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A21R32	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A21R33	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A21R34	0683-2025	R:FXD COMP 2000 OHMS 5% 1/4W	
A21R35	0683-1815	R:FXD COMP 180 OHM 5% 1/4W	
A21R36	0683-5615	R:FXD COMP 560 OHMS 5% 1/4W	
A21R37	0683-6815	R:FXD COMP 680 OHMS 5% 1/4W	
A21R38	0683-2215	R:FXD COMP 220 OHMS 5% 1/4W	
A21R39	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	
A21R40	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A21R41	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A21R42	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A21R43	0683-1815	R:FXD COMP 180 OHM 5% 1/4W	
A21R44	0683-5615	R:FXD COMP 560 OHMS 5% 1/4W	
A21R45	0683-6815	R:FXD COMP 680 OHMS 5% 1/4W	
A21R46	0683-2215	R:FXD COMP 220 OHMS 5% 1/4W	
A21R47	0683-4715	R:FXD 470 OHMS 5% 1/4W	
A21R48	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A21R49	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A21R50	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A21T1	5245A-60A	TRANSFORMER, PULSE	
A22	5243A-65R	ASSY:GATE CONTROL	
	5243A-65R-1	BOARD:BLANK P.C.	
A22C1	0140-0192	C:FXD MICA 68PF 5% 300VDCW	
A22C2	0140-0192	C:FXD MICA 68PF 5% 300VDCW	
A22C3	0140-0201	C:FXD MICA 12PF 5% 500VDCW	
A22C4	0140-0201	C:FXD MICA 12PF 5% 500VDCW	
A22C5	0140-0208	C:FXD MICA 680PF 5% 300VDCW	
A22C6	0180-0100	C:FXD ELECT TA 4.7UF 10% 35VDCW	
A22C7	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
A22C8	0140-0200	C:FXD MICA 390PF 5% 300VDCW	
A22C9	0140-0159	C:FXD MICA 3000PF 300VDCW	
A22C10	0140-0201	C:FXD MICA 12PF 5% 500VDCW	
A22C11	0140-0205	C:FXD MICA 62 PF 5% 300VDCW	
A22C11	-	FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A22CR1	1901-0040	SEMICON DEVICE:DIODE SILICON	
A22CR2	1901-0040	SEMICON DEVICE:DIODE SILICON	
A22CR3	1901-0040	SEMICON DEVICE:DIODE SILICON	
A22CR4	1901-0040	SEMICON DEVICE:DIODE SILICON	
A22CR5	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A22CR6	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	Stock No.	Description #	Note
A22CR7	1901-0040	SEMICON DEVICE:DIODE SILICON	
A22Q1	1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	
A22Q2	1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	
A22Q3	1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	
A22Q4	1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	
A22Q5	1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	
A22Q6	1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	
A22Q7	1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	
A22Q8	1851-0017	TRANSISTOR:2N1304	
A22Q9	1851-0017	TRANSISTOR:2N1304	
A22Q10	1851-0017	TRANSISTOR:2N1304	
A22Q11	1854-0008	TRANSISTOR:NPN SILICON	
A22R1	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A22R2	0683-7535	R:FXD COMP 75K OHM 5% 1/4W	
A22R3	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A22R4	0683-2425	R:FXD COMP 2400 OHMS 5% 1/4W	
A22R5	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A22R6	0683-2425	R:FXD COMP 2400 OHMS 5% 1/4W	
A22R7	0683-1325	R:FXD COMP 1300 OHMS 5% 1/4W	
A22R8	0683-8225	R:FXD COMP 8200 OHMS 5% 1/4W	
A22R9	0683-1545	R:FXD COMP 150K OHMS 5% 1/4W	
A22R10	0683-1545	R:FXD COMP 150K OHMS 5% 1/4W	
A22R11	0683-8225	R:FXD COMP 8200 OHMS 5% 1/4W	
A22R12	0683-1325	R:FXD COMP 1300 OHMS 5% 1/4W	
A22R13	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A22R14	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A22R15	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A22R16	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A22R17	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A22R18	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A22R19	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A22R20	0683-1545	R:FXD COMP 150K OHMS 5% 1/4W	
A22R21	0683-2015	R:FXD COMP 200 OHMS 5% 1/4W	
A22R22	0686-9115	R:FXD COMP 910 OHMS 5% 1/2W	
A22R23	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A22R24	0683-1325	R:FXD COMP 1300 OHMS 5% 1/4W	
A22R25	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A22R26	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A22R27	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A22R28	0683-1325	R:FXD COMP 1300 OHMS 5% 1/4W	
A22R29	0683-2725	R:FXD COMP 2700 OHMS 5% 1/4W	
A22R30	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
A22R31	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
A22R32	0683-1825	R:FXD COMP 1800 OHMS 5% 1/4W	
A22R33	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
A22R34	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A22R35	0683-1625	R:FXD COMP 1600 OHMS 5% 1/4W	
A22R36	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A22R37	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	℗ Stock No.	Description #	Note
A22R38	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A23	5243A-655 5243A-655-1	ASSY:SAMPLING CONTROL BOARD:BLANK P.C.	
A23C1	0140-0159	C:FXD MICA 3000PF 300VDCW	
A23C2	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A23C3	0140-0156	C:FXD MICA 1500 PF 2% 300 VDCW	
A23C4	0180-0137	C:FXD ELECT TA 100 UF 20% 10VDCW	
A23C5	0180-0100	C:FXD ELECT TA 4.7UF 10% 35VDCW	
A23C6	0140-0149	C:FXD MICA 470 PF 5% 300 VDCW	
A23C7	0140-0162	C:FXD MICA 4700 PF 10% 300 VDCW	
A23C8	0180-0100	C:FXD ELECT TA 4.7UF 10% 35VDCW	
A23C9	0160-0161	C:FXD MY 0.01 UF 10% 200VDCW	
A23C10	0140-0152	C:FXD MICA 1000PF 5% 300VDCW	
A23CR1	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A23CR2	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A23CR3	1901-0040	SEMICON DEVICE:DIODE SILICON	
A23CR4	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A23CR5	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A23CR6	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A23CR7	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A23CR8	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A23CR9	1901-0040	SEMICON DEVICE:DIODE SILICON	
A23Q1	1851-0017	TRANSISTOR:2N1304	
A23Q2	1850-0040	TRANSISTOR:GERMANIUM 2N383 PNP	
A23Q3	1850-0062	TRANSISTOR:GERMANIUM	
A23Q4	1850-0062	TRANSISTOR:GERMANIUM	
A23Q5	1853-0001	TRANSISTOR:PNP SILICON 30V 900MW	
A23Q6	1850-0101	TRANSISTOR:SPL2N582	
A23Q7	1850-0040	TRANSISTOR:GERMANIUM 2N383 PNP	
A23Q8	1851-0024	TRANSISTOR:GE NPN 2N388A	
A23Q9	1850-0062	TRANSISTOR:GERMANIUM	
A23Q10	1850-0062	TRANSISTOR:GERMANIUM	
A23Q11	1851-0017	TRANSISTOR:GE NPN 2N1304	
A23Q12	1851-0017	TRANSISTOR:2N1304	
A23R1	0686-3025	R:FXD COMP 3000 OHM 5% 1/2W	
A23R2	0686-1325	R:FXD COMP 1.3K OHM 5% 1/2W	
A23R3	0686-2725	R:FXD COMP 2700 OHM 5% 1/2W	
A23R4	0686-1025	R:FXD COMP 1000 OHM 5% 1/2W	
A23R5	0686-1035	R:FXD COMP 10K OHM 5% 1/2W	
A23R6	0686-1035	R:FXD COMP 10K OHM 5% 1/2W	
A23R7	0686-2225	R:FXD COMP 2200 OHM 5% 1/2W	
A23R8	0686-2225	R:FXD COMP 2200 OHM 5% 1/2W	
A23R9	0686-4735	R:FXD COMP 47K OHM 5% 1/2W	
A23R10	0686-1035	R:FXD COMP 10K OHM 5% 1/2W	
A23R11	0686-4735	R:FXD COMP 47K OHM 5% 1/2W	
A23R12	0686-4735	R:FXD COMP 47K OHM 5% 1/2W	
A23R13	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
A23R14	0686-3625	R:FXD COMP 3600 OHM 5% 1/2W	
A23R15	0686-2225	R:FXD COMP 2200 OHM 5% 1/2W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	Stock No.	Description #	Note
A23R16	0686-2035	R:FXD COMP 20K OHM 5% 1/2W	
A23R17	0686-9125	R:FXD COMP 9100 OHM 5% 1/2W	
A23R18	0758-0015	R:FXD MET FLM 220 OHMS 5% 1/2W	
A23R19	0686-1025	R:FXD COMP 1000 OHM 5% 1/2W	
A23R20	0686-2225	R:FXD COMP 2200 OHM 5% 1/2W	
A23R21	0686-1035	R:FXD COMP 10K OHM 5% 1/2W	
A23R22	0686-1325	R:FXD COMP 1.3K OHM 5% 1/2W	
A23R23	0686-4735	R:FXD COMP 47K OHM 5% 1/2W	
A23R24	0686-2035	R:FXD COMP 20K OHM 5% 1/2W	
A23R25	0686-1035	R:FXD COMP 10K OHM 5% 1/2W	
A23R26	0686-1525	R:FXD COMP 1500 OHM 5% 1/2W	
A23R27	0758-0015	R:FXD MET FLM 220 OHMS 5% 1/2W	
A23R28	0686-1035	R:FXD COMP 10K OHM 5% 1/2W	
A23R29	0686-2225	R:FXD COMP 2200 OHM 5% 1/2W	
A23R30	0686-2225	R:FXD COMP 2200 OHM 5% 1/2W	
A23R31	0686-1225	R:FXD COMP 1200 OHM 5% 1/2W	
A23R32	0686-4725	R:FXD COMP 4700 OHM 5% 1/2W	
A23R33	0686-4725	R:FXD COMP 4700 OHM 5% 1/2W	
A23R34	0686-2735	R:FXD COMP 27K OHM 5% 1/2W	
A23R35	0686-4715	R:FXD COMP 470 OHM 5% 1/2W	
A24	5243A-69A	ASSY:CRYSTAL OVEN	
	5243A-69A-1	BOARD:BLANK P.C.	
A24C1	0130-0001	C:VAR CER 7-45PF 500VDCW	
A24C2	0160-0126	C:FXD PORC 160PF 2% 500VDCW	
A24C3	0140-0151	C:FXD MICA 820PF 2% 300VDCW	
A24C4	0140-0166	C:FXD MICA 0.017 UF 2% 300 VDCW	
A24C5	0140-0159	C:FXD MICA 3000PF 300VDCW	
A24C6	0170-0055	C:FXD MY 0.1UF 20% 200VDCW	
A24C7	0170-0040	C:FXD MY .047 UF 10% 200VDCW	
A24R1	0727-0081	R:FXD DEPC 600 OHM 1% 1/2W	
A24R2	0727-0105	R:FXD C-FLM 1200 OHM 1% 1/2W	
A24R3	0727-0387	R:FXD DEPC 442 OHM 1% 1/2W	
A24R4	2100-0354	R:VAR WW 1000 OHM 10% LIN 2W	
A24Y1	5080-0031	CRYSTAL:1 MC	
A25	5243A-65T	ASSY:OVEN CONTROL	
	5243A-65T-1	BOARD:BLANK P.C.	
A25C1	0180-0100	C:FXD ELECT TA 4.7UF 10% 35VDCW	
A25C2	0180-0100	C:FXD ELECT TA 4.7UF 10% 35VDCW	
A25C3	0180-0100	C:FXD ELECT TA 4.7UF 10% 35VDCW	
A25C4	0180-0049	C:FXD ELECT 20UF 50VDCW	
A25C5	0180-0100	C:FXD ELECT TA 4.7UF 10% 35VDCW	
A25C6	0170-0024	C:FXD MY 0.022 UF 20% 200VDCW	
A25C7	0180-0100	C:FXD ELECT 4.7 UF 10% 35VDCW	
A25CR1	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A25CR2	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A25CR3	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A25CR4	1901-0026	SEMICON DEVICE:DIODE SI	
A25CR5	1901-0026	SEMICON DEVICE:DIODE SILICON 200PIV	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	℗ Stock No.	Description #	Note
A25CR6	1901-0026	SEMICON DEVICE:DIODE SILICON 200PIV	
A25CR7	1901-0026	SEMICON DEVICE:DIODE SILICON 200PIV	
A25CR8	1901-0026	SEMICON DEVICE:DIODE SILICON 200PIV	
A25Q1	1850-0054	TRANSISTOR:GERMANIUM 2N652A PNP	
A25Q2	1853-0001	TRANSISTOR:PNP SILICON 30V 900MW	
A25Q3	1850-0054	TRANSISTOR:GERMANIUM 2N652A PNP	
A25Q4	1850-0040	TRANSISTOR:GERMANIUM 2N383 PNP	
A25R1	0683-4325	R:FXD COMP 4300 OHM 5% 1/4W	
A25R2	0683-4325	R:FXD COMP 4300 OHM 5% 1/4W	
A25R3	0683-8215	R:FXD COMP 820 OHM 5% 1/4W	
A25R4	0683-1235	R:FXD COMP 12K OHM 5% 1/4W	
A25R5	0683-1835	R:FXD COMP 18K OHM 5% 1/4W	
A25R6	0699-0013	R:FXD COMP 6.8 OHM 10% 1W	
A25R7	0767-0001	R:FXD MET FLM 400 OHMS 5% 3W	
A25R8	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A25R9	0683-2205	R:FXD COMP 22 OHM 5% 1/4W	
A25R10	0683-1515	R:FXD COMP 150 OHM 5% 1/4W	
A26	5243A-65F	ASSY:OSCILLATOR	
	5243A-65F-1	BOARD:BLANK P.C.	
A26C1	0160-0194	C:FXD MY 0.015UF 10%	
A26C2	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A26C3	0160-0194	C:FXD MY 0.015UF 10%	
A26C4	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A26C5	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A26C6	0170-0084	C:FXD MY 0.068UF 20% 50VDCW	
A26C7	0140-0200	C:FXD MICA 390PF 5% 300VDCW	
A26C8	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A26C9	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A26C10	0160-0194	C:FXD MY 0.015UF 10%	
A26C11	0140-0190	C:FXD MICA 39 PF 5% 300 VDCW	
A26C12	0160-0194	C:FXD MY 0.015UF 10%	
A26C13	0170-0084	C:FXD MY 0.068UF 20% 50VDCW	
A26C14	0160-0194	C:FXD MY 0.015UF 10%	
A26C15	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A26C16	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A26C17	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A26C18	0160-0194	C:FXD MY 0.015UF 10%	
A26C19	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A26C20	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A26C21	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A26C22	0160-0194	C:FXD MY 0.015 UF 10%	
A26C23	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A26C24	0140-0190	C:FXD MICA 39 PF 5% 300 VDCW	
A26C25	0160-0194	C:FXD MY 0.015 UF 10%	
A26C26	0160-0127	C:FXD CER 1.0 UF 20% 25VDCW	
A26C27	0140-0202	C:FXD MICA 15 PF 5% 500VDCW	
A26CR1	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A26CR2	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A26CR3	1901-0025	SEMICON DEVICE:DIODE JUNCTION	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	ℎp Stock No.	Description #	Note
A26CR4	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A26L1	9140-0138	COIL:FXD RF 180 UH	
A26L2	9140-0137	COIL:FXD RF 100 UH	
A26L3	9140-0137	COIL:FXD RF 100 UH	
A26L4	9140-0138	COIL:FXD RF 180 UH	
A26L5	9140-0138	COIL:FXD RF 180 UH	
A26Q1	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
A26Q2	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
A26Q3	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
A26Q4	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
A26Q5	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
A26Q6	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
A26Q7	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
A26R1	0683-1825	R:FXD COMP 1800 OHMS 5% 1/4W	
A26R2	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A26R3	0683-3915	R:FXD COMP 390 OHMS 5% 1/4W	
A26R4	0683-3915	R:FXD COMP 390 OHMS 5% 1/4W	
A26R5	0683-3915	R:FXD COMP 390 OHMS 5% 1/4W	
A26R6	0683-3915	R:FXD COMP 390 OHMS 5% 1/4W	
A26R7	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A26R8	0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	
A26R9	0683-1535	R:FXD COMP 15K OHMS 5% 1/4W	
A26R10	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A26R11	0683-2725	R:FXD COMP 2700 OHMS 5% 1/4W	
A26R12	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A26R13	0683-1235	R:FXD COMP 12K OHM 5% 1/4W	
A26R14	0683-2725	R:FXD COMP 2700 OHMS 5% 1/4W	
A26R15	0683-1305	R:FXD COMP 13 OHMS 5% 1/4W	
A26R16	0683-1825	R:FXD COMP 1800 OHMS 5% 1/4W	
A26R17	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A26R18	0683-2715	R:FXD COMP 270 OHMS 5% 1/4W	
A26R19	0683-1235	R:FXD COMP 12K OHM 5% 1/4W	
A26R20	0683-2725	R:FXD COMP 2700 OHMS 5% 1/4W	
A26R21	0683-2215	R:FXD COMP 220 OHMS 5% 1/4W	
A26R22	0683-1825	R:FXD COMP 1800 OHMS 5% 1/4W	
A26R23	0683-1525	R:FXD COMP 150 OHMS 5% 1/4W	
A26R24	0683-6825	R:FXD COMP 6800 OHMS 5% 1/4W	
A26R25	0683-2025	R:FXD COMP 2000 OHMS 5% 1/4W	
A26R26	0683-1225	R:FXD COMP 1200 OHMS 5% 1/4W	
A26R27	0683-6215	R:FXD COMP 620 OHMS 5% 1/4W	
A26R28	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A26R29	0683-2725	R:FXD COMP 2700 OHMS 5% 1/4W	
A26R30	0683-1135	R:FXD COMP 11K OHM 5% 1/4W	
A26R31	0683-6215	R:FXD COMP 620 OHMS 5% 1/4W	
A26R32	0683-1825	R:FXD COMP 1800 OHMS 5% 1/4W	
A26R33	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A26R34	0683-5115	R:FXD COMP 510 OHM 5% 1/4W	
A26R35	0683-4705	R:FXD COMP 47 OHM 5% 1/4W	
A26R36	0686-6815	R:FXD COMP 680 OHM 5% 1/2W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	ℌ Stock No.	Description #	Note
A26R37	0758-0025	R:FXD MET FLM 160 OHMS 5% 1/2W	
A26R38	0683-1825	R:FXD COMP 1800 OHMS 5% 1/4W	
A27	5243A-65C	ASSY:MULTIPLIER	
	5243A-65C-1	BOARD:BLANK P.C.	
A27C1	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A27C2	0140-0196	C:FXD MICA 150 PF 5% 300 VDCW	
A27C3	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A27C4	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A27C5	0140-0200	C:FXD MICA 390PF 5% 300VDCW	
A27C6	0160-0194	C:FXD MY 0.015UF 10%	
A27C7	0140-0201	C:FXD MICA 12PF 5% 500VDCW	
A27C8	0140-0208	C:FXD MICA 680PF 5% 300VDCW	
A27C9	0160-0155	C:FXD MY 3300 PF 10%	
A27C10	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A27C11	0140-0192	C:FXD MICA 68PF 5% 300VDCW	
A27C12	0160-0194	C:FXD MY 0.015UF 10%	
A27C13	0140-0195	C:FXD MICA 130 PF 5% 300 VDCW	
A27C14	0160-0157	C:FXD MY 4700 PF 10%	
A27C15	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A27C16	0140-0199	C:FXD MICA 240PF 5% 300VDCW	
A27C17	0160-0194	C:FXD MY 0.015UF 10%	
A27C18	0140-0209	C:FXD MICA 5PF 10% 500VDCW	
A27C19	0140-0199	C:FXD MICA 240PF 5% 300VDCW	
A27C20	0140-0200	C:FXD MICA 390PF 5% 300VDCW	
A27L1	5243A-60A	INDUCTOR: VAR, 8-20UH	
A27L2	5243A-60A	INDUCTOR: VAR, 8-20UH	
A27L3	5243A-60B	INDUCTOR: VAR, 2-4UH	
A27L4	5243A-60B	INDUCTOR: VAR, 2-4UH	
A27L5	5243A-60C	INDUCTOR: VAR, 1-2UH	
A27L6	5243A-60C	INDUCTOR: VAR, 1-2UH	
A27Q1	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
A27Q2	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
A27Q3	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
A27R1	0683-1525	R:FXD COMP 150 OHMS 5% 1/4W	
A27R2	0683-1015	R:FXD COMP 100 OHMS 5% 1/4W	
A27R3	0683-1015	R:FXD COMP 100 OHMS 5% 1/4W	
A27R4	0683-1635	R:FXD COMP 16K OHMS 5% 1/4W	
A27R5	0683-5125	R:FXD COMP 5100 OHMS 5% 1/4W	
A27R6	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A27R7	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	
A27R8	0683-1135	R:FXD COMP 11K OHM 5% 1/4W	
A27R9	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A27R10	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A27R11	0683-1015	R:FXD COMP 100 OHMS 5% 1/4W	
A27R12	0683-9125	R:FXD COMP 9100 OHMS 5% 1/4W	
A27R13	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A27R14	0683-6815	R:FXD COMP 680 OHMS 5% 1/4W	
A27R15	0683-1015	R:FXD COMP 100 OHMS 5% 1/4W	
A27R16	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	℗ Stock No.	Description #	Note
A27R17	0683-1015	R:FXD COMP 100 OHMS 5% 1/4W	
A28	5232A-65H	ASSY:DECADE DIVIDER	
	5232A-65H-1	BOARD:BLANK P.C.	
A28C1	0140-0191	C:FXD MICA 56 PF 5% 300 VDCW	
A28C2	0140-0191	C:FXD MICA 56 PF 5% 300 VDCW	
A28C3	0150-0121	C:FXD CER 0.1UF 50 VDCW	
A28C4	0160-0179	C:FXD MICA 33PF 5% 300VDCW	
A28C5	0150-0122	C:FXD CER 2000PF 20% 500VDCW	
A28C6	0140-0191	C:FXD MICA 56 PF 5% 300 VDCW	
A28C7	0160-0196	C:FXD MICA 24PF 5% 300VDCW	
A28C8	0140-0191	C:FXD MICA 56 PF 5% 300 VDCW	
A28C9	0150-0122	C:FXD CER 2000PF 20% 500VDCW	
A28C10	0140-0191	C:FXD MICA 56 PF 5% 300 VDCW	
A28C11	0140-0192	C:FXD MICA 68PF 5% 300VDCW	
A28C12	0140-0205	C:FXD MICA 62PF 5% 300VDCW	
A28C13	0140-0205	C:FXD MICA 62PF 5% 300VDCW	
A28C14	0140-0191	C:FXD MICA 56 PF 5% 300 VDCW	
A28C15	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
A28C16	0140-0192	C:FXD MICA 68PF 5% 300VDCW	
A28C17	0140-0196	C:FXD MICA 150 PF 5% 300 VDCW	
A28CR1	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A28CR2	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A28CR3	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A28CR4	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A28CR5	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A28CR6	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A28CR7	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A28CR8	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A28CR9	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A28CR10	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A28CR11	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A28Q1	1850-0105	TRANSISTOR-GERMANIUM PNP SPL 2N2048	
A28Q2	1850-0105	TRANSISTOR-GERMANIUM PNP SPL 2N2048	
A28Q3	1850-0105	TRANSISTOR-GERMANIUM PNP SPL 2N2048	
A28Q4	1850-0105	TRANSISTOR-GERMANIUM PNP SPL 2N2048	
A28Q5	1850-0105	TRANSISTOR-GERMANIUM PNP SPL 2N2048	
A28Q6	1850-0105	TRANSISTOR-GERMANIUM PNP SPL 2N2048	
A28Q7	1850-0105	TRANSISTOR-GERMANIUM PNP SPL 2N2048	
A28Q8	1850-0105	TRANSISTOR-GERMANIUM PNP SPL 2N2048	
A28R1	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A28R2	0758-0024	R:FXD MET FLM 100 OHMS 5% 1/2W	
A28R3	0758-0043	R:FXD MET FLM 1400 OHMS 5% 1/2W	
A28R4	0683-1635	R:FXD COMP 16K OHMS 5% 1/4W	
A28R5	0683-2725	R:FXD COMP 2700 OHMS 5% 1/4W	
A28R6	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
A28R7	0683-6205	R:FXD COMP 62 OHMS 5% 1/4W	
A28R8	0683-5605	R:FXD COMP 56 OHM 5% 1/4W	
A28R9	0683-6205	R:FXD COMP 62 OHMS 5% 1/4W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	Stock No.	Description #	Note
A28R10	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
A28R11	0758-0043	R:FXD MET FLM 1400 OHMS 5% 1/2W	
A28R12	0683-1635	R:FXD COMP 16K OHMS 5% 1/4W	
A28R13	0683-2725	R:FXD COMP 2700 OHMS 5% 1/4W	
A28R14	0758-0043	R:FXD MET FLM 1400 OHMS 5% 1/2W	
A28R15	0683-1635	R:FXD COMP 16K OHMS 5% 1/4W	
A28R16	0683-2725	R:FXD COMP 2700 OHMS 5% 1/4W	
A28R17	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
A28R18	0683-6205	R:FXD COMP 62 OHMS 5% 1/4W	
A28R19	0683-5605	R:FXD COMP 56 OHM 5% 1/4W	
A28R20	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A28R21	0683-6205	R:FXD COMP 62 OHMS 5% 1/4W	
A28R22	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
A28R23	0758-0043	R:FXD MET FLM 1400 OHMS 5% 1/2W	
A28R24	0683-1635	R:FXD COMP 16K OHMS 5% 1/4W	
A28R25	0683-2725	R:FXD COMP 2700 OHMS 5% 1/4W	
A28R26	0758-0004	R:FXD MET FLM 2700 OHMS 5% 1/2W	
A28R27	0683-1635	R:FXD COMP 16K OHMS 5% 1/4W	
A28R28	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A28R29	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
A28R30	0683-4705	R:FXD COMP 47 OHM 5% 1/4W	
A28R31	0683-1015	R:FXD COMP 100 OHMS 5% 1/4W	
A28R32	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A28R33	0683-4705	R:FXD COMP 47 OHM 5% 1/4W	
A28R34	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
A28R35	0758-0004	R:FXD MET FLM 2700 OHMS 5% 1/2W	
A28R36	0683-1635	R:FXD COMP 16K OHMS 5% 1/4W	
A28R37	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A28R38	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A28R39	0683-3025	R:FXD COMP 3000 OHMS 5% 1/4W	
A28R40	0758-0004	R:FXD MET FLM 2700 OHMS 5% 1/2W	
A28R41	0683-1635	R:FXD COMP 16K OHMS 5% 1/4W	
A28R42	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A28R43	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
A28R44	0683-1015	R:FXD COMP 100 OHMS 5% 1/4W	
A28R45	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A28R46	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
A28R47	0758-0004	R:FXD MET FLM 2700 OHMS 5% 1/2W	
A28R48	0683-1635	R:FXD COMP 16K OHMS 5% 1/4W	
A28R49	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A29	5212A-65C	ASSY:DECADE DIVIDER	
	5212A-65C-1	BOARD:BLANK P.C.	
A29C1	0150-0121	C:FXD CER 0.1UF 50 VDCW	
A29C2	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
A29C3	0140-0195	C:FXD MICA 130 PF 5% 300 VDCW	
A29C4	0140-0195	C:FXD MICA 130 PF 5% 300 VDCW	
A29C5	0140-0196	C:FXD MICA 150 PF 5% 300 VDCW	
A29C6	0140-0196	C:FXD MICA 150 PF 5% 300 VDCW	
A29C7	0140-0196	C:FXD MICA 150 PF 5% 300 VDCW	
A29C8	0140-0199	C:FXD MICA 240PF 5% 300VDCW	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index(cont'd)

Reference Designation	℔ Stock No.	Description #	Note
A29C9	0140-0195	C:FXD MICA 130 PF 5% 300 VDCW	
A29C10	0140-0195	C:FXD MICA 130 PF 5% 300 VDCW	
A29C11	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
A29C12	0140-0198	C:FXD MICA 200PF 5% 300VDCW	
A29C13	0140-0198	C:FXD MICA 200PF 5% 300VDCW	
A29C14	0140-0200	C:FXD MICA 390PF 5% 300VDCW	
A29CR1	1910-0015	SEMICON DEVICE:DIODE GERMANIUM	
A29CR2	1910-0015	SEMICON DEVICE:DIODE GERMANIUM	
A29CR3	1910-0015	SEMICON DEVICE:DIODE GERMANIUM	
A29CR4	1910-0015	SEMICON DEVICE:DIODE GERMANIUM	
A29CR5	1910-0015	SEMICON DEVICE:DIODE GERMANIUM	
A29Q1	1850-0062	TRANSISTOR:GERMANIUM	
A29Q2	1850-0062	TRANSISTOR:GERMANIUM	
A29Q3	1850-0062	TRANSISTOR:GERMANIUM	
A29Q4	1850-0062	TRANSISTOR:GERMANIUM	
A29Q5	1850-0062	TRANSISTOR:GERMANIUM	
A29Q6	1850-0062	TRANSISTOR:GERMANIUM	
A29Q7	1850-0062	TRANSISTOR:GERMANIUM	
A29Q8	1850-0062	TRANSISTOR:GERMANIUM	
A29R1	0683-3915	R:FXD COMP 390 OHMS 5% 1/4W	
A29R2	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A29R3	0683-6825	R:FXD COMP 6800 OHMS 5% 1/4W	
A29R4	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A29R5	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A29R6	0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	
A29R7	0683-2015	R:FXD COMP 200 OHMS 5% 1/4W	
A29R8	0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	
A29R9	0683-6825	R:FXD COMP 6800 OHMS 5% 1/4W	
A29R10	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A29R11	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A29R12	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A29R13	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A29R14	0683-6825	R:FXD COMP 6800 OHMS 5% 1/4W	
A29R15	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A29R16	0683-8225	R:FXD COMP 8200 OHMS 5% 1/4W	
A29R17	0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	
A29R18	0683-2015	R:FXD COMP 200 OHMS 5% 1/4W	
A29R19	0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	
A29R20	0683-6825	R:FXD COMP 6800 OHMS 5% 1/4W	
A29R21	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A29R22	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A29R23	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A29R24	0683-6835	R:FXD COMP 68K OHM 5% 1/4W	
A29R25	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A29R26	0683-6825	R:FXD COMP 6800 OHMS 5% 1/4W	
A29R27	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A29R28	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A29R29	0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	
A29R30	0683-2015	R:FXD COMP 200 OHMS 5% 1/4W	
A29R31	0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	Stock No.	Description #	Note
A29R32	0683-6825	R:FXD COMP 6800 OHMS 5% 1/4W	
A29R33	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A29R34	0683-8225	R:FXD COMP 8200 OHMS 5% 1/4W	
A29R35	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A29R36	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A29R37	0683-6825	R:FXD COMP 6800 OHMS 5% 1/4W	
A29R38	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A29R39	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A29R40	0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	
A29R41	0683-2015	R:FXD COMP 200 OHMS 5% 1/4W	
A29R42	0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	
A29R43	0683-6825	R:FXD COMP 6800 OHMS 5% 1/4W	
A29R44	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A29R45	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A29R46	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A30	5212A-65C	SAME AS A29:USE PREFIX A30	
A31	5212A-65C	SAME AS A29:USE PREFIX A31	
A32	5212A-65C	SAME AS A29:USE PREFIX A32	
A33	5212A-65C	SAME AS A29:USE PREFIX A33	
A34	5212A-65C	SAME AS A29:USE PREFIX A34	
A35	5243A-65J	ASSY:TIME-BASE CONTROL	
	5243A-65J-1	BOARD:BLANK P.C.	
A35C1	0160-0134	C:FXD MICA 220PF 5% 300VDCW	
A35C2	0160-0134	C:FXD MICA 220PF 5% 300VDCW	
A35C3	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
A35C4	0160-0134	C:FXD MICA 220PF 5% 300VDCW	
A35C5	0160-0134	C:FXD MICA 220PF 5% 300VDCW	
A35C6	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
A35C7	0160-0134	C:FXD MICA 220PF 5% 300VDCW	
A35C8	0160-0134	C:FXD MICA 220PF 5% 300VDCW	
A35C9	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
A35C10	0160-0134	C:FXD MICA 220PF 5% 300VDCW	
A35C11	0160-0134	C:FXD MICA 220PF 5% 300VDCW	
A35C12	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
A35C13	0160-0134	C:FXD MICA 220PF 5% 300VDCW	
A35C14	0160-0134	C:FXD MICA 220PF 5% 300VDCW	
A35C15	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
A35CR1	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A35CR2	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A35CR3	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A35CR4	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A35CR5	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A35CR6	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A35CR7	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A35CR8	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A35CR9	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A35CR10	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A35CR11	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A35CR12	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A35CR13	1901-0025	SEMICON DEVICE:DIODE JUNCTION	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	℗ Stock No.	Description #	Note
A35CR14	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A35CR15	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A35CR16	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A35CR17	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A35CR18	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A35CR19	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A35CR20	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A35CR21	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A35CR22	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A35CR23	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A35E1	9170-0016	BEAD:MAGNETIC	
A35Q1	1850-0040	TRANSISTOR:GERMANIUM 2N383 PNP	
A35Q2	1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	
A35Q3	1850-0062	TRANSISTOR:GERMANIUM	
A35Q4	1850-0062	TRANSISTOR:GERMANIUM	
A35Q5	1850-0062	TRANSISTOR:GERMANIUM	
A35Q6	1850-0062	TRANSISTOR:GERMANIUM	
A35Q7	1850-0062	TRANSISTOR:GERMANIUM	
A35Q8	1850-0062	TRANSISTOR:GERMANIUM	
A35Q9	1850-0062	TRANSISTOR:GERMANIUM	
A35Q10	1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	
A35Q11	1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	
A35Q12	1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	
A35R1	0758-0054	R:FXD MET FLM 330 OHMS 5% 1/2W	
A35R2	0689-1525	R:FXD COMP 1500 OHM 5% 1W	
A35R3	0683-2025	R:FXD COMP 2000 OHMS 5% 1/4W	
A35R4	0683-3025	R:FXD COMP 3000 OHMS 5% 1/4W	
A35R5	0686-1825	R:FXD COMP 1800 OHM 5% 1/2W	
A35R6	0683-3025	R:FXD COMP 3000 OHMS 5% 1/4W	
A35R7	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A35R8	0683-3025	R:FXD COMP 3000 OHMS 5% 1/4W	
A35R9	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A35R10	0683-3025	R:FXD COMP 3000 OHMS 5% 1/4W	
A35R11	0683-1535	R:FXD COMP 15K OHMS 5% 1/4W	
A35R12	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A35R13	0683-3025	R:FXD COMP 3000 OHMS 5% 1/4W	
A35R14	0683-1535	R:FXD COMP 15K OHMS 5% 1/4W	
A35R15	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A35R16	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A35R17	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A35R18	0683-1845	R:FXD COMP 180K OHMS 5% 1/4W	
A35R19	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A35R20	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A35R21	0683-3025	R:FXD COMP 3000 OHMS 5% 1/4W	
A35R22	0683-1535	R:FXD COMP 15K OHMS 5% 1/4W	
A35R23	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A35R24	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A35R25	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A35R26	0683-1845	R:FXD COMP 180K OHMS 5% 1/4W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	Stock No.	Description #	Note
A35R27	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A35R28	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A35R29	0683-3025	R:FXD COMP 3000 OHMS 5% 1/4W	
A35R30	0683-1535	R:FXD COMP 15K OHMS 5% 1/4W	
A35R31	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A35R32	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A35R33	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A35R34	0683-1845	R:FXD COMP 180K OHMS 5% 1/4W	
A35R35	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A35R36	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A35R37	0683-3025	R:FXD COMP 3000 OHMS 5% 1/4W	
A35R38	0683-1535	R:FXD COMP 15K OHMS 5% 1/4W	
A35R39	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A35R40	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A35R41	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A35R42	0683-1845	R:FXD COMP 180K OHMS 5% 1/4W	
A35R43	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A35R44	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A35R45	0683-3025	R:FXD COMP 3000 OHMS 5% 1/4W	
A35R46	0683-1535	R:FXD COMP 15K OHMS 5% 1/4W	
A35R47	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A35R48	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A35R49	0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	
A35R50	0683-1845	R:FXD COMP 180K OHMS 5% 1/4W	
A35R51	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A35R52	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A35R53	0683-3025	R:FXD COMP 3000 OHMS 5% 1/4W	
A35R54	0683-1535	R:FXD COMP 15K OHMS 5% 1/4W	
A35R55	0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	
A35R56	0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	
A35R57	0683-2435	R:FXD COMP 24K OHM 5% 1/4W	
A35R58	0683-2025	R:FXD COMP 2000 OHMS 5% 1/4W	
A35R59	0683-3025	R:FXD COMP 3000 OHMS 5% 1/4W	
A35R60	0683-2025	R:FXD COMP 2000 OHMS 5% 1/4W	
A35R61	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	
A35R62	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A35R63	0683-2025	R:FXD COMP 2000 OHMS 5% 1/4W	
A35R64	0683-2025	R:FXD COMP 2000 OHMS 5% 1/4W	
A35R65	0683-2025	R:FXD COMP 2000 OHMS 5% 1/4W	
A36	05245A-16A	ASSEMBLY:CABLE (INCLUDES A36R1)	
A36R1	0683-5105	R:FXD COMP 51 OHM 5% 1/4W	
B1	3140-0010	MOTOR:AC 1/175 HP 2800 RPM	
C1	0170-0073	C:FXD MY 1UF 10% 600VDCW	
C2	0130-0003	C:VAR CER 1.5-7 PF 500VDCW	
C3	0121-0013	C:VAR AIR 6-100.5PF	
C4	0180-0047	C:FXD ELECT 500UF 75VDCW	
C5	0150-0119	C:FXD CER 2X(.01UF) 20% 250VDCW	
C6	0180-0129	C:FXD ELECT 975LF -10+50% 40VDCW	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	Stock No.	Description #	Note
C7	0180-0107	C:FXD ELECT 20UF -10/+100% 200VDCW	
C8	0180-0107	C:FXD ELECT 20UF -10/+100% 200VDCW	
C9	0180-0129	C:FXD ELECT 975UF -10+50% 40VDCW	
C10	0180-0130	C:FXD ELECT 1500UF -10+50% 15VDCW	
C11	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
C12	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
C13	0150-0121	C:FXD:CER:0.1UF 50 VDCW	
C14	0150-0012	C:FXD CER 0.01UF 20% 1000VDCW	
C15	0160-0127	C:FXD CER 1UF 20% 25VDCW	
CR1	1902-0039	SEMICON DEVICE:DIODE 1N1597ASILICON	
DS1	1450-0049	INDICATOR:GLOW-LAMP NEON	
F1	2110-0006	FUSE:CARTRIDGE 2AMP 125V SLOW BLOW (115V OPERATION ONLY)	
F1	2110-0007	FUSE:CARTRIDGE 1 AMP 250V SLOW BLOW (230V OPERATION ONLY)	
J1	1250-0118	CONNECTOR:BNC	
J2	1250-0118	CONNECTOR:BNC	
J3	1250-0118	CONNECTOR:BNC	
J4	1250-0118	CONNECTOR:BNC	
J5	1250-0118	CONNECTOR:BNC	
J6	1251-0101	CONNECTOR:FEMALE 50-CONTACT	
J7	1250-0083	CONNECTOR:BNC	
J8	1250-0083	CONNECTOR:BNC	
J9	1251-0085	CONNECTOR:FEMALE 36-PIN MINAT	
J10	1251-0085	CONNECTOR:FEMALE 36-PIN MINAT	
J11	1251-0087	CONNECTOR:FEMALE 50-PIN MINAT	
L1	9140-0136	COIL:FXD RF 22 UH	
L2	9140-0136	COIL:FXD RF 22 UH	
L3	9110-0051	INDUCTOR:A.F.	
L4	9110-0051	INDUCTOR:A.F.	
L5	9140-0137	COIL:FXD RF 100 UH	
MP1	0370-0077	KNOB:1/4 BAR WITH ARROW	
MP2	0370-0077	KNOB:1/4 BAR WITH ARROW	
MP3	0370-0077	KNOB:1/4 BAR WITH ARROW	
MP4	0370-0077	KNOB:1/4 BAR WITH ARROW	
MP5	0370-0077	KNOB:1/4 BAR WITH ARROW	
MP6	0370-0084	KNOB:ROUND	
MP7	0510-0123	RETAINER:PUSH-ON TYPE FASTENER	
MP8	1200-0043	INSULATOR:TRANSISTOR ANODIZED ALUMINUM	
MP9	1200-0043	INSULATOR:TRANSISTOR ANODIZED ALUMINUM	
MP10	1200-0043	INSULATOR:TRANSISTOR ANODIZED ALUMINUM	
MP11	1200-0076	INSULATOR:TRANISTOR	
MP12	1200-0081	BUSHING:INSULATOR NYLON	
MP13	1200-0081	BUSHING:INSULATOR NYLON	
MP14	1200-0081	BUSHING:INSULATOR NYLON	
MP15	1200-0081	BUSHING:INSULATOR NYLON	
MP16	1200-0081	BUSHING:INSULATOR NYLON	
MP17	1200-0081	BUSHING:INSULATOR NYLON	
MP18	1200-0087	CLAMP:TRANSISTOR	
MP19	1200-0092	BUSHING:TRANSISTOR	
MP20	1200-0092	BUSHING:TRANSISTOR	
MP21	1520-0001	PLATE:MOUNTING ELECTROLYTIC CAPACITOR	
MP22	1520-0001	PLATE:MOUNTING ELECTROLYTIC CAPACITOR	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	Stock No.	Description #	Note
MP23	1520-0001	PLATE:MOUNTING ELECTROLYTIC CAPACITOR	
MP24	1520-0001	PLATE:MOUNTING ELECTROLYTIC CAPACITOR	
MP25	1520-0003	MOUNTING PLATE:CAPACITOR	
MP26	1520-0003	MOUNTING PLATE:CAPACITOR	
MP27	2190-0046	WASHER:SPLIT LOCK	
MP28	2190-0046	WASHER:SPLIT LOCK	
MP29	2190-0046	WASHER:SPLIT LOCK	
MP30	2190-0046	WASHER:SPLIT LOCK	
MP31	2190-0046	WASHER:SPLIT LOCK	
MP32	2190-0046	WASHER:SPLIT LOCK	
MP33	2390-0015	SCREW:MACHINE	
MP34	3160-0034	FAN IMPELLER:AXIAL	
MP35	5212A-83A	SUPPORT:READOUT	
MP36	5212L-83B	READOUT:UNITS	
MP37	5243A-2A	PANEL:PLUG-IN	
MP38	5243A-6A	GUARD:FAN	
MP39	5243A-12A	BRACKET:TRANSFORMER	
MP40	5243A-12C	BRACKET:SWITCH	
MP41	5243A-12C	BRACKET:SWITCH	
MP42	5243A-12C	BRACKET:SWITCH	
MP43	5243A-12E	SUPPORT:CAPACITOR	
MP44	5243A-12F	BRACKET:CRYSTAL OVEN	
MP45	5243A-20A	HOUSING:FAN	
MP46	5243A-47C	SUPPORT:PANEL	
MP47	5243A-55A	SHIELD:OSCILLATOR	
MP48	5243A-66A	SUPPORT:BOARD	
MP49	5243L-12B	BRACKET:BOARD	
MP50	5243L-12C	BRACKET:BOARD GUIDE	
MP51	5243L-17A	BUSHING:LATCH	
MP52	5243L-17A	BUSHING:LATCH	
MP53	5243L-20A	HOUSING:PLUG-IN	
MP54	5243L-37A	SHAFT:LATCH	
MP55	5243L-37A	SHAFT:LATCH	
MP56	5243L-41A	PLATE:CASTING	
MP57	5243L-55B	SHIELD:INPUT	
MP58	5243L-74A	KNOB	
MP59	5243L-74A	KNOB	
MP60	5243L-83A	HOLDER:DECIMAL	
MP61	5243L-83B	COVER:READOUT	
MP62	5243L-83C	INSERT:UNITS READOUT	
MP63	5243L-83D	RAMP:LATCH	
MP64	5243L-83D	RAMP:LATCH	
MP65	5243L-91A	SPRING:LATCH	
MP66	5243L-91A	SPRING:LATCH	
MP67	5243L-99A	WINDOW	
MP68	5243L-107A	BAR:READOUT	
MP69	5243L-109A	PAWL	
MP70	5243L-109A	PAWL	
MP71	5243L-110A	GUIDE:BOARD FRONT	
MP72	5243L-110B	GUIDE:BOARD REAR	
MP73	5243L-110C	GUIDE:BOARD DUAL	
MP74	5245L-2A	PANEL:FRONT	
MP75	5245L-2B	PANEL:REAR	
MP76	5245L-55A	SHIELD:AMPLIFIER	
Q1	1850-0090	TRANSISTOR:GERMANIUM 2N1183B PNP	
Q2	1850-0038	TRANSISTOR:PNP GERMANIUM	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (cont'd)

Reference Designation	Stock No.	Description #	Note
Q3	1850-0038	TRANSISTOR:PNP GERMANIUM	
Q4	1850-0038	TRANSISTOR:PNP GERMANIUM	
R1	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
R2	0683-2245	R:FXD COMP 220K OHM 5% 1/4W	
R3	0683-8235	R:FXD COMP 82K OHM 5% 1/4W	
R4	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
R5	2100-0318	R:VAR 250K OHM 20% 1/4W/SPST SW	
R6	0686-1045	R:FXD COMP 100K OHM 5% 1/2W	
R7	0686-3325	R:FXD COMP 3300 OHM 5% 1/2W	
S1	3101-0037	SWITCH:TOG SPST 3 AMP 125V	
S2	3101-0014	SWITCH:PUSH SPDT NE	
S3		NOT SEPARATELY REPLACEABLE PARTOF R5	
S4	3101-0034	SWITCH:SLIDE 4 PDT 0.5 AMP 125 VDC	
T1	9100-0166	TRANSFORMER:POWER	
T2	9100-0164	TRANSFORMER:POWER	
W1	8120-0078	CABLE:POWER SVT-18-3 7.5FT.	
XA6	1251-0159	CONNECTOR:2X15 CONTACT	
XA7	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA8 THRU			
XA9		NOT ASSIGNED	
XA10	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA11	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA12	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA13	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA14	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA15	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA16	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA17	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA18	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA19 THRU			
XA21		NOT ASSIGNED	
XA22	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA23	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA24 THRU			
XA25		NOT ASSIGNED	
XA26	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS AND	
XA26	1251-0158	CONNECTOR:6-CONTACT	
XA27	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA28	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA29	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA30	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA31	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA32	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA33	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XA34	1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	
XF1	1400-0084	FUSEHOLDER:EXTRACTOR POST TYPE	
XW1	1251-0148	CONNECTOR:POWER 3-PIN MALE	
		MISCELLANEOUS	
	5243A-85A	AIR FILTER ASSY	
	5243A-44A	KIT: 51/4'' RACK MOUNT	
	8500-0059	SILICONE GREASE:FOR TRANSISTOR HEAT-SINK	

See list of abbreviations in introduction to this section

Table 6-2 Replaceable Parts

℘ Stock No.	Description #	Mfr.	Mfr. Part No.	TQ	RS
05245A-16A	ASSEMBLY:CABLE	28480	05245A-16A	1	
5212A-65C	ASSY:DECADE DIVIDER	28480	5212A-65C	6	
5212A-65C-1	BOARD:BLANK P.C.	28480	5212A-65C-1	6	
5212A-83A	SUPPORT:READOUT	28480	5212A-83A	1	
5212A-83C	COVER:COLUMN	28480	5212A-83C	8	
5212A-83H	BLOCK:PHOTOCONDUCTOR	28480	5212A-83H	8	
5212L-4A	ASSY:DECIMAL COUNTER	28480	5212L-4A	5	
5212L-4A-1	BLANK BOARD P.C.	28480	5212L-4A-1	5	
5212L-83B	READOUT:UNITS	28480	5212L-83B	1	
5212L-83C	READOUT:IN-LINE	28480	5212L-83C	8	
5232A-65H	ASSY:DECADE DIVIDER	28480	5232A-65C	1	
5232A-65H-1	BOARD:BLANK P.C.	28480	5232A-65H-1	1	
5232L-4B	ASSY:DECIMAL COUNTER	28480	5232L-4B	2	
5243A-12A	BRACKET:TRANSFORMER	28480	5243A-12A	1	
5243A-12C	BRACKET:SWITCH	28480	5243A-12C	3	
5243A-12E	SUPPORT:CAPACITOR	28480	5243A-12E	1	
5243A-12F	BRACKET:CRYSTAL OVEN	28480	5243A-12F	1	
5243A-2A	PANEL:PLUG-IN	28480	5243A-2A	1	
5243A-20A	HOUSING:FAN	28480	5243A-20A	1	
5243A-44A	KIT: 51/4'' RACK MOUNT	28480	5243A-44A	1	
5243A-47C	SUPPORT:PANEL	28480	5243A-47C	1	
5243A-55A	SHIELD:OSCILLATOR	28480	5243A-55A	1	
5243A-6A	GUARD:FAN	28480	5243A-6A	1	
5243A-60A	INDUCTOR: VAR, 8-20UH	28480	5243A-60A	2	
5243A-60B	INDUCTOR: VAR, 2-4UH	28480	5243A-60B	2	
5243A-60C	INDUCTOR: VAR, 1-2UH	28480	5243A-60C	2	
5243A-65A-1	BOARD:BLANK P.C.	28480	5243A-65A-1	1	
5243A-65C	ASSY:MULTIPLIER	28480	5243A-65C	1	
5243A-65C-1	BOARD:BLANK P.C.	28480	5243A-65C-1	1	
5243A-65F	ASSY:OSCILLATOR	28480	5243A-65F	1	
5243A-65F-1	BOARD:BLANK P.C.	28480	5243A-65F:1	1	
5243A-65H	ASSY:REGULATOR	28480	5243A-65H	1	
5243A-65H-1	BOARD:BLANK P.C.	28480	5243A-65H-1	1	
5243A-65J	ASSY:TIME-BASE CONTROL	28480	5243A-65J	1	
5243A-65J-1	BOARD:BLANK P.C.	28480	5243A-65J-1	1	
5243A-65L	ASSY:RECTIFIER	28480	5243A-65L	1	
5243A-65L-1	BOARD:BLANK P.C.	28480	5243A-65L-1	1	
5243A-65R	ASSY:GATE CONTROL	28480	5243A-65R	1	
5243A-65R-1	BOARD:BLANK P.C.	28480	5243A-65R-1	1	
5243A-65S	ASSY:SAMPLING CONTROL	28480	5243A-65E	1	
5243A-65S-1	BOARD:BLANK P.C.	28480	5243A-65S-1	1	
5243A-65T	ASSY:OVEN CONTROL	28480	5243A-65T	1	
5243A-65T-1	BOARD:BLANK P.C.	28480	5243A-65T-1	1	
5243A-66A	SUPPORT:BOARD	28480	5243A-66A	1	
5243A-69A	ASSY:CRYSTAL OVEN	28480	5243A-69A	1	
5243A-69A-1	BOARD:BLANK P.C.	28480	5243A 69A 1	1	
5243A-85A	AIR FILTER ASSY	28480	5243A-85A	1	
5243L-107A	BAR:READOUT	28480	5243L-107A	1	
5243L-109A	PAWL	28480	5243L-109A	2	
5243L-110A	GUIDE:BOARD FRONT	28480	5243L-110A	1	

See list of abbreviations in introduction to this section

Table 6-2. Replaceable Parts (Cont'd)

℗ Stock No.	Description #	Mfr.	Mfr. Part No.	TQ	RS
5243L-110B	GUIDE:BOARD REAR	28480	5243L-110B	1	
5243L-110C	GUIDE:BOARD DUAL	28480	5243L-110C	1	
5243L-12B	BRACKET:BOARD	28480	5243L-12B	1	
5243L-12C	BRACKET:BOARD GUIDE	28480	5243L-12C	1	
5243L-17A	BUSHING:LATCH	28480	5243L-17A	2	
5243L-20A	HOUSING:PLUG-IN	28480	5243L-20A	1	
5243L-37A	SHAFT:LATCH	28480	5243L:37A	2	
5243L-41A	PLATE:CASTING	28480	5243L-41A	1	
5243L-55B	SHIELD:INPUT	28480	5243L-55B	1	
5243L-65A	ASSY:DECIMAL POINT	28480	5243L-65A	1	
5243L-65B	ASSY:MEASUREMENT UNITS	28480	5243L-65B	1	
5243L-65B-1	BOARD:BLANK P.C.	28480	5243L-65B-1	1	
5243L-74A	KNOB	28480	5243L-74A	2	
5243L-83A	HOLDER:DECIMAL	28480	5243L-83A	1	
5243L-83B	COVER:READOUT	28480	5243L-83B	1	
5243L-83C	INSERT:UNITS READOUT	28480	5243L-83C	1	
5243L-83D	RAMP:LATCH	28480	5243L-83D	2	
5243L-91A	SPRING:LATCH	28480	5243L-91A	2	
5243L-99A	WINDOW	28480	5243L-99A	1	
5245A-60A	TRANSFORMER: PULSE	28480	5245A-60A	1	
5245A-65C	ASSY:DECIMAL COUNTER	28480	5245A-65C	1	
5245A-65C-1	BOARD:BLANK P.C.	28480	5245A-65C-1	1	
5245A-65K	ASSY:FUNCTION CONTROL	28480	5245A-65K	1	
5245A-65K-1	BOARD:BLANK P.C.	28480	5245A-65K-1	1	
5245A-65M	ASSY:INPUT AMPLIFIER	28480	5245A-65M	2	
5245A-65M-1	BOARD:BLANK P.C.	28480	5245A-65M-1	2	
5245L-19A	ASSY:OUTPUT SWITCH	28480	5245L-19A	1	
5245L-19B	ASSY:MODE SWITCH	28480	5245L-19B	1	
5245L-19C	ASSY:PANEL SWITCH	28480	5245L-19C	1	
5245L-2A	PANEL:FRONT	28480	5245L-2A	1	
5245L-2B	PANEL:REAR	28480	5245L-2B	1	
5245L-4B	ASSY:READOUT	28480	5245L-4B	1	
5245L-55A	SHIELD:AMPLIFIER	28480	5245L-55A	1	
0121-0013	C:VAR AIR 6-100.5PF	80486	OBS#	1	
0121-0039	C:VAR CER 8-50PF 350WVDC	72982	55-027-N750-8-50PF	1	
0130-0001	C:VAR CER 7-45PF 500VDCW	72982	50300D2P0	1	
0130-0003	C:VAR CER 1.5-7 PF 500VDCW	72982	503-000C0P0-10R	1	
0130-0018	C:VAR CER 1.5-7 PF 500 VDCW	72982	557-019-C0P0-10R	1	
0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	04062	DM15C220J	10	
0140-0149	C:FXD MICA 470 PF 5% 300 VDCW	04062	DM15F471J	5	
0140-0151	C:FXD MICA 820PF 2% 300VDCW	04062	DM15F821G	1	
0140-0152	C:FXD MICA 1000PF 5% 300VDCW	04062	DM16F102J	1	
0140-0156	C:FXD MICA 1500 PF 2% 300 VDCW	04062	DM19F152G 300V	1	
0140-0159	C:FXD MICA 3000PF 300VDCW	04062	DM19F302G	3	
0140-0162	C:FXD MICA 4700 PF 10% 300 VDCW	04062	DM20F472K	1	
0140-0166	C:FXD MICA 0.017 UF 2% 300 VDCW	04062	DM30F173G	1	
0140-0178	C:FXD MICA 560 PF 2% 300 VDCW	04062	DM15F561G 300V	2	
0140-0190	C:FXD MICA 39 PF 5% 300 VDCW	04062	DM15E390J 300V	8	
0140-0191	C:FXD MICA 56 PF 5% 300 VDCW	04062	DM15E560J 300V	8	
0140-0192	C:FXD MICA 68PF 5% 300VDCW	04062	DM15E680J	7	

See list of abbreviations in introduction to this section

Table 6-2. Replaceable Parts (cont'd)

℗ Stock No.	Description #	Mfr.	Mfr. Part No.	TQ	RS
0140-0193	C:FXD MICA 82 PF 5% 300 VDC#	04062	DM15E820J 300V	3	
0140-0194	C:FXD MICA 110 PF 5% 300 VDC#	04062	DM15F111J 300V	49	
0140-0195	C:FXD MICA 130 PF 5% 300 VDC#	04062	DM15F131J 300V	35	
0140-0196	C:FXD MICA 150 PF 5% 300 VDC#	04062	DM15F151J 300V	22	
0140-0198	C:FXD MICA 200PF 5% 300VDC#	04062	DM15F201J 300V	29	
0140-0199	C:FXD MICA 240PF 5% 300VDC#	04062	DM15F241J 300V	13	
0140-0200	C:FXD MICA 390PF 5% 300VDC#	04062	DM15F391J 300V	13	
0140-0201	C:FXD MICA 12PF 5% 500VDC#	04062	DM15C120J	5	
0140-0202	C:FXD MICA 15 PF 5% 500VDC#	04062	DM15C150J	5	
0140-0203	C:FXD MICA 30PF 5% 500VDC#	04062	DM15E300J 500V	4	
0140-0204	C:FXD MICA 47PF 5% NPO 500VDC#	04062	DM15E470J	7	
0140-0205	C:FXD MICA 62PF 5% 300VDC#	04062	DM15E620J 300V	5	
0140-0208	C:FXD MICA 680PF 5% 300VDC#	04062	DM15F681J	3	
0140-0209	C:FXD MICA 5PF 10% 500VDC#	04062	DM15C050K 500V	1	
0140-0210	C:FXD MICA 270PF 5% 300VDC#	04062	DM15F271J 300V	3	
0140-0214	C:FXD MICA 60PF 5% 300VDC#	04062	DM15E600J 300V	2	
0140-0217	C:FXD MICA 140 PF 2% 300VDC#	04062	DM15F141G-300V	5	
0150-0012	C:FXD CER 0.01UF 20% 1000VDC#	56289	H 1038	2	
0150-0050	C:FXD CER 100 PF 600 VDC#	000RR	TYPE E	1	
0150-0093	C:FXD CER 0.01UF +80-20 100VDC#	91418	TA	26	
0150-0119	C:FXD CER 2X(.01UF) 20% 250VDC#	56289	41C159A	1	
0150-0121	C:FXD CER 0.1UF 50 VDC#	56289	5C50A	8	
0150-0122	C:FXD CER 2000PF 20% 500VDC#	72982	801 000 Y5S 202M	6	
0160-0126	C:FXD PORC 160PF 2% 500VDC#	95275	VY13C161G	1	
0160-0127	C:FXD CER 1UF 20% 25VDC#	56289	5C13	12	
0160-0134	C:FXD MICA 220PF 5% 300VDC#	14655	CD15F221J(300V)	10	
0160-0155	C:FXD MY 3300 PF 10%	28480	0160-0155	1	
0160-0157	C:FXD MY 4700 PF 10%	28480	0160 0157	1	
0160-0161	C:FXD MY 0.01 UF 10% 200VDC#	28480	0160 0161	1	
0160-0179	C:FXD MICA 33PF 5% 300VDC#	04062	DM15E330J	3	
0160-0194	C:FXD MY 0.015UF 10%	28480	0160-0194	11	
0160-0196	C:FXD MICA 24PF 5% 300VDC#	04062	DM15C240J	1	
0170-0024	C:FXD MY 0.022 UF 20% 200VDC#	56289	192P22302A	1	
0170-0040	C:FXD MY .047 UF 10% 200VDC#	56289	192P47392	3	
0170-0055	C:FXD MY 0.1UF 20% 200VDC#	56289	192P10402	1	
0170-0073	C:FXD MY 1UF 10% 600VDC#	09134	1041	1	
0170-0084	C:FXD MY 0.068UF 20% 50VDC#	84411	601PE STYLE 3	3	
0170-0094	C:FXD MY 0.047UF 20% 50VDC#	84411	TYPE 602	2	
0180-0039	C:FXD ELECT 100UF 12VDC#	56289	30D154A1	1	
0180-0047	C:FXD ELECT 500UF 75VDC#	56289	D32443	1	
0180-0049	C:FXD ELECT 20UF 50VDC#	56289	30D198A1	1	
0180-0058	C:FXD ELECT 50UF -10%+100% 25VDC#	56289	TYPE 30D186A1	2	
0180-0100	C:FXD ELECT TA 4.7UF 10% 35VDC#	56289	150D475X9035B2	8	
0180-0107	C:FXD ELECT 20UF -10/+100% 200VDC#	56289	90803	2	
0180-0129	C:FXD ELECT 975UF -10+50% 40VDC#	56289	S37006	2	
0180-0130	C:FXD ELECT 1500UF -10+50% 15VDC#	00853	PLI 505 1007 02	1	
0180-0137	C:FXD ELECT TA 100 UF 20% 10VDC#	56289	150D107X0010R2	1	
0370-0077	KNOB:1/4 BAR #ITH ARROW	28480	0370-0077	5	
0370-0084	KNOB:ROUND	28480	0370-0084	1	
0510-0123	RETAINER:PUSH-ON TYPE FASTENER	78553	C12006-014-4	1	

See list of abbreviations in introduction to this section

Table 6-2. Replaceable Parts (Conf'd)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ	RS
0683-0475	R:FXD COMP 4.7 OHMS 5% 1/4W	01121	CB 47G5	1	
0683-1015	R:FXD COMP 100 OHMS 5% 1/4W	01121	CB 1015	12	
0683-1025	R:FXD COMP 1000 OHMS 5% 1/4W	01121	CB-1025	18	
0683-1035	R:FXD COMP 10K OHMS 5% 1/4W	01121	CB 1035	100	
0683-1045	R:FXD COMP 100K OHM 5% 1/4W	01121	CB 1045	33	
0683-1055	R:FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055	15	
0683-1135	R:FXD COMP 11K OHM 5% 1/4W	01121	CB 1135	2	
0683-1225	R:FXD COMP 1200 OHMS 5% 1/4W	01121	CB 1225	3	
0683-1235	R:FXD COMP 12K OHM 5% 1/4W	01121	CB 1235	3	
0683-1245	R:FXD COMP 120K OHM 5% 1/4W	01121	CB 1245	8	
0683-1305	R:FXD COMP 13 OHMS 5% 1/4W	01121	CB 1305	1	
0683-1325	R:FXD COMP 1300 OHMS 5% 1/4W	01121	CB 1325	5	
0683-1515	R:FXD COMP 150 OHM 5% 1/4W	01121	CB 1515	1	
0683-1525	R:FXD COMP 150 OHMS 5% 1/4W	01121	CB 1525	2	
0683-1535	R:FXD COMP 15K OHMS 5% 1/4W	01121	CB 1535	8	
0683-1545	R:FXD COMP 150K OHM 5% 1/4W	01121	CB 1545	7	
0683-1625	R:FXD COMP 1600 OHMS 5% 1/4W	01121	CB 1625	1	
0683-1635	R:FXD COMP 16K OHM 5% 1/4W	01121	CB 1635	19	
0683-1815	R:FXD COMP 180 OHM 5% 1/4W	01121	CB 1815	22	
0683-1825	R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825	18	
0683-1835	R:FXD COMP 18K OHM 5% 1/4W	01121	CB 1835	13	
0683-1845	R:FXD COMP 180K OHMS 5% 1/4W	01121	CB 1845	5	
0683-2015	R:FXD COMP 200 OHMS 5% 1/4W	01121	CB 2015	29	
0683-2025	R:FXD COMP 2000 OHMS 5% 1/4W	01121	CB 2025	18	
0683-2035	R:FXD COMP 20K OHMS 5% 1/4W	01121	CB 2035	3	
0683-2205	R:FXD COMP 22 OHM 5% 1/4W	01121	CB 2205	1	
0683-2215	R:FXD COMP 220 OHMS 5% 1/4W	01121	CB 2215	4	
0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	01121	GB 2225	14	
0683-2235	R:FXD COMP 22K OHM 5% 1/4W	01121	CB 2235	13	
0683-2245	R:FXD COMP 220K OHM 5% 1/4W	01121	CB 2245	2	
0683-2415	R:FXD COMP 240 OHMS 5% 1/4W	01121	CB 2415	3	
0683-2425	R:FXD COMP 2400 OHMS 5% 1/4W	01121	CB 2425	2	
0683-2435	R:FXD COMP 24K OHM 5% 1/4W	01121	CB 2435	3	
0683-2705	R:FXD COMP 27 OHM 5% 1/4W	01121	CB 2705	8	
0683-2715	R:FXD COMP 270 OHMS 5% 1/4W	01121	CB 2715	1	
0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	01121	CB 2725	22	
0683-2735	R:FXD COMP 27K OHM 5% 1/4W	01121	CB 2735	3	
0683-3025	R:FXD COMP 3000 OHM 5% 1/4W	01121	CB 3025	16	
0683-3305	R:FXD COMP 33 OHMS 5% 1/4W	01121	CB 3305	1	
0683-3315	R:FXD COMP 330 OHMS 5% 1/4W	01121	CB 3315	6	
0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325	3	
0683-3615	R:FXD COMP 360 OHM 5% 1/4W	01121	CB 3615	1	
0683-3915	R:FXD COMP 390 OHMS 5% 1/4W	01121	CB 3915	12	
0683-3925	R:FXD COMP 3900 OHMS 5% 1/4W	01121	CB 3925	89	
0683-3945	R:FXD COMP 390K OHMS 5% 1/4W	01121	CB 3945	32	
0683-4315	R:FXD COMP 430 OHMS 5% 1/4W	01121	CB 4315	3	
0683-4325	R:FXD COMP 4300 OHM 5% 1/4W	01121	CB 4325	2	
0683-4335	R:FXD COMP 43K OHM 5% 1/4W	01121	CB 4335	41	
0683-4705	R:FXD COMP 47 OHM 5% 1/4W	01121	CB 4705	7	
0683-4715	R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715	8	

See list of abbreviations in introduction to this section

Table 6-2. Replaceable Parts (Cont'd)

℗ Stock No.	Description #	Mfr.	Mfr. Part No.	TQ	RS
0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725	24	
0683-4735	R:FXD COMP 47K OHMS 5% 1/4W	01121	CB 4735	25	
0683-5105	R:FXD COMP 51 OHM 5% 1/4W	01121	CB 5105	5	
0683-5115	R:FXD COMP 510 OHMS 5% 1/4W	01121	CB 5115	6	
0683-5125	R:FXD COMP 5100 OHMS 5% 1/4W	01121	CB 5125	1	
0683-5135	R:FXD COMP 51K OHMS 5% 1/4W	01121	CB 5135	10	
0683-5605	R:FXD COMP 56 OHM 5% 1/4W	01121	CB 5605	6	
0683-5615	R:FXD COMP 560 OHMS 5% 1/4W	01121	CB 5615	5	
0683-5635	R:FXD COMP 56K OHMS 5% 1/4W	01121	CB 5635	68	
0683-6205	R:FXD COMP 62 OHMS 5% 1/4W	01121	CB 6205	4	
0683-6215	R:FXD COMP 620 OHMS 5% 1/4W	01121	CB 6215	2	
0683-6225	R:FXD COMP 6200 OHMS 5% 1/4W	01121	CB 6225	3	
0683-6805	R:FXD COMP 68 OHMS 5% 1/4W	01121	CB 6805	4	
0683-6815	R:FXD COMP 680 OHMS 5% 1/4W	01121	CB 6815	6	
0683-6825	R:FXD COMP 6800 OHMS 5% 1/4W	01121	CB 6825	51	
0683-6835	R:FXD COMP 68K OHM 5% 1/4W	01121	CB 6835	19	
0683-7505	R:FXD COMP 75 OHM 5% 1/4W	01121	CB 7505	4	
0683-7515	R:FXD COMP 750 OHMS 5% 1/4W	01121	CB 7515	3	
0683-7525	R:FXD COMP 7500 OHMS 5% 1/4W	01121	CB 7525	9	
0683-7535	R:FXD COMP 75K OHM 5% 1/4W	01121	CB 7535	1	
0683-8215	R:FXD COMP 820 OHMS 5% 1/4W	01121	CB 8215	5	
0683-8225	R:FXD COMP 8200 OHMS 5% 1/4W	01121	CB 8225	24	
0683-8235	R:FXD COMP 82K OHM 5% 1/4W	01121	EB 8235	1	
0683-9105	R:FXD COMP 910 OHM 5% 1/4W	01121	CB 9105	5	
0683-9115	R:FXD COMP 910 OHM 5% 1/4W	01121	CB 9115	2	
0683-9125	R:FXD COMP 9100 OHMS 5% 1/4W	01121	CB 9125	1	
0683-9135	R:FXD COMP 91K OHMS 5% 1/4W	01121	CB 9135	1	
0686-1025	R:FXD COMP 1000 OHM 5% 1/2W	01121	EB 1025	3	
0686-1035	R:FXD COMP 10K OHM 5% 1/2W	01121	EB 1035	6	
0686-1045	R:FXD COMP 100K OHM 5% 1/2W	01121	EB 1045	1	
0686-1225	R:FXD COMP 1200 OHM 5% 1/2W	01121	EB 1225	2	
0686-1325	R:FXD COMP 1.3K OHM 5% 1/2W	01121	EB 1325	2	
0686-1525	R:FXD COMP 1500 OHM 5% 1/2W	01121	EB 1525	1	
0686-1825	R:FXD COMP 1800 OHM 5% 1/2W	01121	EB 1825	1	
0686-2035	R:FXD COMP 20K OHM 5% 1/2W	01121	EB 2035	2	
0686-2225	R:FXD COMP 2200 OHM 5% 1/2W	01121	EB 2225	6	
0686-2235	R:FXD COMP 22K OHM 5% 1/2W	01121	EB 2235	1	
0686-2725	R:FXD COMP 2700 OHM 5% 1/2W	01121	EB 2725	1	
0686-2735	R:FXD COMP 27K OHM 5% 1/2W	01121	EB 2735	2	
0686-3025	R:FXD COMP 3000 OHM 5% 1/2W	01121	EB 3025	1	
0686-3325	R:FXD COMP 3300 OHM 5% 1/2W	01121	EB 3325	1	
0686-3625	R:FXD COMP 3600 OHM 5% 1/2W	01121	EB 3625	2	
0686-4715	R:FXD COMP 470 OHMS 5% 1/2W	01121	EB 4715	2	
0686-4725	R:FXD COMP 4700 OHM 5% 1/2W	01121	EB 4725	2	
0686-4735	R:FXD COMP 47K OHM 5% 1/2W	01121	EB 4735	1	
0686 4735	R:FXD COMP 47K OHM 5% 1/2W	01121	EB 4735	1	
0686-4735	R:FXD COMP 47K OHM 5% 1/2W	01121	EB 4735	2	
0686 4735	R:FXD COMP 47K OHM 5% 1/2W	01121	EB 4735	1	
0686-4735	R:FXD COMP 47K OHM 5% 1/2W	01121	EB 4735	4	
0686 4735	R:FXD COMP 47K OHM 5% 1/2W	01121	EB 4735	1	

See list of abbreviations in introduction to this section

Table 6-2. Replaceable Parts (Cont'd)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ	RS
0686-4735	R:FXD COMP 47K OHM 5% 1/2W	01121	EB 4735	1	
0686 4735	R:FXD COMP 47K OHM 5% 1/2W	01121	EB 4735	1	
0686-4735	R:FXD COMP 47K OHM 5% 1/2W	01121	EB 4735	1	
0686 4735	R:FXD COMP 47K OHM 5% 1/2W	01121	EB 4735	1	
0686-4735	R:FXD COMP 47K OHM 5% 1/2W	01121	EB 4735	1	
0686 4735	R:FXD COMP 47K OHM 5% 1/2W	01121	EB 4735	2	
0686-6215	R:FXD COMP 620 OHM 5% 1/2W	01121	EB 6215	3	
0686-6815	R:FXD COMP 680 OHM 5% 1/2W	01121	EB 6815	1	
0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	01121	EB 7525	42	
0686-8215	R:FXD COMP 820 OHM 5% 1/2W	01121	EB 8215	2	
0686-9115	R:FXD COMP 910 OHMS 5% 1/2W	01121	EB 9115	1	
0686-9125	R:FXD COMP 9100 OHM 5% 1/2W	01121	EB 9125	1	
0689-1525	R:FXD COMP 1500 OHM 5% 1W	01121	GB 1525	1	
0689 2035	R:FXD COMP 20K OHM 5% 1W	01121	GB 2035	1	
0699-0013	R:FXD COMP 6.8 OHM 10% 1W	01121	GB 68G1	1	
0727-0081	R:FXD DEPC 600 OHM 1% 1/2W	19701	DC 1/2 AR5	1	
0727-0105	R:FXD C-FLM 1200 OHM 1% 1/2W	28480	0727-0105	1	
0727-0387	R:FXD DEPC 442 OHM 1% 1/2W	19701	DC 1/2A R5	1	
0758-0004	R:FXD MET FLM 2700 OHM 5% 1/2W	07115	C 20	12	
0758-0015	R:FXD MET FLM 220 OHMS 5% 1/2W	07115	C 20	7	
0758-0024	R:FXD MET FLM 100 OHMS 5% 1/2W	07115	C 20	1	
0758-0025	R:FXD MET FLM 160 OHMS 5% 1/2W	07115	C 20	1	
0758-0028	R:FXD MET FLM 270 OHMS 5% 1/2W	07115	C 20	1	
0758-0043	R:FXD MET FLM 1800 OHM 5% 1/2W	07115	C 20	12	
0758-0054	R:FXD MET FLM 330 OHMS 5% 1/2W	07115	C 20	1	
0761-0020	R:FXD MET FLM 91 OHM 5% 1W	07115	C32	1	
0766-0032	R:FXD MET FLM 835 OHMS 2% 3W	07115	LPI 3	2	
0767-0001	R:FXD MET FLM 400 OHMS 5% 3W	07115	LPI 3	1	
0845-0001	NETWORK:RESISTIVE(10 RESISTORS)	28480	0845-0001	7	
0905-0043	GASKET:PHOTOCONDUCTOR	28480	0905-0043	8	
0905-0051	GASKET:FELT	28480	0905-0051	8	
1200-0043	INSULATOR:TRANSISTOR ANODIZED ALUMINUM	76530	294457	3	
1200-0076	INSULATOR:TRANISTOR	02735	OBS#	1	
1200-0081	BUSHING:INSULATOR NYLON	26365	974SPECIAL	6	
1200-0087	CLAMP:TRANSISTOR	02735	DF-13-A	1	
1200-0092	BUSHING:TRANSISTOR	02735	OBS#	2	
1250-0083	CONNECTOR:BNC	91737	UG-1094/U	2	
1250-0118	CONNECTOR:BNC	91737	8427	5	
1251-0085	CONNECTOR:FEMALE 36-PIN MINAT	02660	57-40360(375)	2	
1251-0087	CONNECTOR:FEMALE 50-PIN MINAT	02660	57-4057-40500(375)	1	
1251-0101	CONNECTOR:FEMALE 50-CONTACT	02660	57-20500	1	
1251-0135	CONNECTOR-PRINTED CIRCUIT 15 CONTACTS	95354	SD-615UR	21	
1251-0148	CONNECTOR:POWER 3-PIN MALE	60427	H-1061 1G-3L	1	
1251-0158	CONNECTOR:6-CONTACT	95354	CD-606S	1	
1251-0159	CONNECTOR:2X15 CONTACT	95354	FD-630S	1	
1400-0084	FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014	1	
1450-0049	INDICATOR:GLOW-LAMP NEON	28480	1450-0049	1	
1520-0001	PLATE:MOUNTING ELECTROLYTIC CAPACITOR	28480	1520-0001	4	
1520-0003	MOUNTING PLATE:CAPACITOR	37942	TYPE BP2	2	
1850-0038	TRANSISTOR:PNP GERMANIUM	86684	1850-0038	3	

See list of abbreviations in introduction to this section

Table 6-2. Replaceable Parts (Cont'd)

ℎ Stock No.	Description #	Mfr.	Mfr. Part No.	TQ	RS
1850-0040	TRANSISTOR:GERMANIUM 2N383 PNP	94154	2N383	4	
1850-0048	TRANSISTOR:GERMANIUM 2N650 PNP	04713	2N650	1	
1850-0054	TRANSISTOR:GERMANIUM 2N652A PNP	04713	2N652A	2	
1850-0062	TRANSISTOR:GERMANIUM	28480	1850-0062	102	
1850-0090	TRANSISTOR:GERMANIUM 2N1183B PNP	86684	2N1183B	1	
1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	87216	2N2048	10	
1850-0101	TRANSISTOR:SPL2N582	28480	1850-0101	1	
1850-0102	TRANSISTOR:GE2N2455	28480	1854-0102	4	
1850-0105	TRANSISTOR-GERMANIUM PNP SPL 2N2048	11711	2N2048	24	
1851-0017	TRANSISTOR:2N1304	01295	2N1304	6	
1851-0024	TRANSISTOR:GE NPN 2N388A	12952	N388A	1	
1853-0001	TRANSISTOR:PNP SILICON 30V 900MW	28480	1853-0001	4	
1853-0003	TRANSISTOR:PNP SILICON	28480	1853-0003	2	
1854-0005	TRANSISTOR:2N708 NPN SILICON PLANAR	07263	2N708	17	
1854-0008	TRANSISTOR:NPN SILICON	28480	1854-0008	1	
1854-0009	TRANSISTOR:2N709 NPN SILICON	07263	2N709	18	
1854-0015	TRANSISTOR:SI NPN	07910	CDQ 10192	8	
1854-0018	TRANSISTOR:SILICON NPN 12V	28480	1854-0018	2	
1901-0025	SEMICON DEVICE:DIODE JUNCTION	28480	1901-0025	124	
1901-0026	SEMICON DEVICE:DIODE SI	14099	SA-783	5	
1901-0029	SEMICON DEVICE:DIODE SI 600V	28480	1901-0029	2	
1901-0040	SEMICON DEVICE:DIODE SILICON	28480	1901 0040	18	
1901-0045	SEMICON DEVICE:DIODE SI	14099	SA-788	10	
1901-0049	SEMICON DEVICE:DIODE SI	14099	SC-05	4	
1902-0017	SEMICON DEVICE:DIODE SI	28480	1902-0017	2	
1902-0039	SEMICON DEVICE:DIODE 1N1597ASILICON	81438	1N1597A/3Z22T5	1	
1902-0057	SEMICON DEVICE:DIODE SILICON	28480	1902-0057	1	
1902-0124	SEMICON DEVICE:DIODE BREAKDOWN	28480	ZA 6166	1	
1910-0015	SEMICON DEVICE:DIODE GERMANIUM	73293	HD-1409	55	
1910-0016	SEMICON DEVICE:DIODE GERMANIUM	93332	D2361	41	
1910-0021	SEMICON DEVICE:DIODE	73293	HPS 1672A	25	
1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	28480	1910-0022	14	
1970-0009	ELECTRON TUBE:INDICATOR 10 DIGIT	83594	B5991	8	
1990-0009	PLATE:PHOTOCONDUCTOR	28480	1990-0009	8	
2100-0318	R:VAR 250K OHM 20% 1/4W/SPST SW	28480	2100)0318	1	
2100-0323	R:VAR COMP 500 OHM 20% LIN 1/3W	28480	2100)0323	3	
2100-0354	R:VAR WW 1000 OHM 10% LIN 2W	28480	2100 0354	1	
2100-0392	R:VAR WW LIN 2K OHM 10% 0.25W	28480	2100-0392	4	
2110-0006	FUSE:CARTRIDGE 2AMP 125V SLOW BLOW	71400	MDL2	1	
2110-0007	FUSE:CARTRIDGE 1 AMP 250V SLOW BLOW	71400	MDL 1	1	
2140-0015	LAMP:GLOW NEON NE-2H	24455	NE 2H	6	
2140-0044	LAMP:NEON SELECTED MATCHED PAIR	28480	2140-0044	32	
2190-0046	WASHER:SPLIT LOCK	28480	2190-0046	6	
2390-0015	SCREW:MACHINE	73076	OBD#	1	
3100-0315	SWITCH:ROTARY 6 SECT 10 POS	28480	3100 0315	1	
3100-0380	SWITCH:ROT 5-SECT 5-POS	28480	3100-0380	1	
3100-0389	SWITCH:ROT 1-SECT 3-POS HP SPEC	28480	3100-0389	1	
3100-0390	SWITCH:ROT 2-SECT 9-POS HP SPEC	28480	3100-0390	1	
3101-0014	SWITCH:PUSH SPDT NE	82389	4S-1106	1	
3101-0034	SWITCH:SLIDE 4 PDT 0.5 AMP 125 VDC	42190	6633	1	

See list of abbreviations in introduction to this section

Table 6-2. Replaceable Parts (Cont'd)

ℎ Stock No.	Description #	Mfr.	Mfr. Part No.	TQ	RS
3101-0037	SWITCH:TOG SPST 3 AMP 125V	04009	83050-A	1	
3140-0010	MOTOR:AC 1/175 HP 2800 RPM	73793	ER 6667	1	
3160-0034	FAN IMPELLER:AXIAL	04870	ULHB 182B	1	
5080-0031	CRYSTAL:1 MC	28480	5080-0031	1	
8120-0078	CABLE:POWER SVT-18-3 7.5FT.	70903	KH4147	1	
8500-0059	SILICONE GREASE(FOR TRANSISTOR HEAT-SINK	71984	#5 COMPOUND	1	
9100-0164	TRANSFORMER:POWER	28480	9100-0164	1	
9100-0166	TRANSFORMER:POWER	28480	9100-0166	1	
9110-0051	INDUCTOR:A.F.	28480	9110-0051	2	
9140-0114	COIL:FXD RF 10 UH	28480	9140-0114	4	
9140-0136	COIL:FXD RF 22 UH	28480	9140-0136	2	
9140-0137	COIL:FXD RF 100 UH	28480	9140-0137	3	
9140-0138	COIL:FXD RF 180 UH	28480	9140-0138	3	
9140-0141	COIL:FXD RF 0.68 UH	28480	9140-0141	1	
9140-0143	COIL:FXD RF 3.3 UH	28480	9140-0143	3	
9140-0146	COIL:FXD RF 10.0 UH	28480	9140-0146	2	
9140-0158	COIL:FXD 1.0UH 10%	99800	1025-20	2	
9140-0159	COIL:FXD 0.47UH 20%	99800	1025-SERIES	4	
9170-0016	BEAD:MAGNETIC	02114	56-590-6513B	1	

See list of abbreviations in introduction to this section

Table 6-3. Code List of Manufacturers (Sheet 1 of 2)

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 handbooks.

Code No.	Manufacturer	Address
00000	U.S.A. Common	Any supplier of U.S.
00136	McCoy Electronics	Mount Holly Springs, Pa.
00334	Humidaire Co.	Colton, Calif.
00335	Westrex Corp.	New York, N.Y.
00373	Garlock Packing Co., Electronic Products Div.	Camden, N.J.
00656	Aerovox Corp.	New Bedford, Mass.
00779	Amp, Inc.	Harrisburg, Pa.
00781	Aircraft Radio Corp.	Boonton, N.J.
00815	Northern Engineering Laboratories, Inc.	Burlington, Wis.
00853	Sangamo Electric Company, Ordill Division (Capacitors)	Marion, Ill.
00866	Goe Engineering Co.	Los Angeles, Calif.
00891	Carl E. Holmes Corp.	Los Angeles, Calif.
01121	Allen Bradley Co.	Milwaukee, Wis.
01255	Litton Industries, Inc.	Beverly Hills, Calif.
01281	Pacific Semiconductors, Inc.	Culver City, Calif.
01295	Texas Instruments, Inc. Transistor Products Div.	Dallas, Texas
01349	The Alliance Mfg. Co.	Alliance, Ohio
01561	Chassi-Trak Corp.	Indianapolis, Ind.
01589	Pacific Relays, Inc.	Van Nuys, Calif.
01930	Amerock Corp	Rockford, Ill.
01961	Pulse Engineering Co.	Santa Clara, Calif.
02114	Ferroxcube Corp. of America	Saugerties, N.Y.
02286	Cole Mfg. Co.	Palo Alto, Calif.
02660	Amphenol-Borg Electronics Corp.	Chicago, Ill.
02735	Radio Corp. of America, Semiconductor and Materials Div.	Somerville, N.J.
02771	Vocaline Co. of America, Inc.	Old Saybrook, Conn.
02777	Hopkins Engineering Co.	San Fernando, Calif.
03508	G.E. Semiconductor Products Dept.	Syracuse, N.Y.
03705	Apex Machine & Tool Co.	Dayton, Ohio
03797	Eldema Corp.	El Monte, Calif.
03877	Transitron Electronic Corp.	Wakefield, Mass.
03888	Pyrofilm Resistor Co.	Morristown, N.J.
03954	Air Marine Motors, Inc.	Los Angeles, Calif.
04009	Arrow, Hart and Hegeman Elect. Co.	Hartford, Conn.
04062	Elmenco Products Co.	New York, N.Y.
04222	Ni-Q Division of Aerovox	Myrtle Beach, S.C.
04298	Elgin National Watch Co., Electronics Division	Burbank, Calif.
04404	Dymec Division of Hewlett-Packard Co.	Palo Alto, Calif.
04651	Sylvania Electric Prods., Inc. Electronic Tube Div.	Mountain View, Calif.
04713	Motorola, Inc., Semiconductor Prod. Div.	Phoenix, Arizona
04732	Filtron Co., Inc., Western Div.	Culver City, Calif.
04773	Automatic Electric Co.	Northlake, Ill.
04777	Automatic Electric Sales Corp.	Northlake, Ill.
04796	Sequoia Wire & Cable Co.	Redwood City, Calif.
04870	P. M. Motor Company	Chicago 44, Ill.
05006	Twentieth Century Plastics, Inc.	Los Angeles, Calif.
05277	Westinghouse Electric Corp., Semi-Conductor Dept.	Youngwood, Pa.
05347	Ultronix, Inc.	San Mateo, Calif.
05593	Illumitronic Engineering Co.	Sunnyvale, Calif.
05624	Barber Colman Co.	Rockford, Ill.
05728	Tiffen Optical Co.	Roslyn Heights, Long Island, N.Y.
05729	Metropolitan Telecommunications Corp., Metro Cap. Division	Brooklyn, N.Y.
05783	Stewart Engineering Co.	Santa Cruz, Calif.
06004	The Bassick Co.	Bridgeport, Conn.
06175	Bausch and Lomb Optical Co.	Rochester, N.Y.
06402	E.T.A. Products Co. of America	Chicago, Ill.
06555	Beede Electrical Instrument Co., Inc.	Penacook, N.H.
06751	U. S. Semcor Division of Nuclear Corp. of America	Phoenix, Arizona
06812	Torrington Mfg. Co., West Div.	Van Nuys, Calif.
07115	Corning Glass Works Electronic Components Dept.	Bradford, Pa.
07126	Digitran Co.	Pasadena, Calif.
07137	Transistor Electronics Corp.	Minneapolis, Minn.
07138	Westinghouse Electric Corp. Electronic Tube Div.	Elmira, N.Y.
07261	Avnet Corp.	Los Angeles, Calif.
07263	Fairchild Semiconductor Corp.	Mountain View, Calif.
07322	Minnesota Rubber Co.	Minneapolis, Minn.
07700	Technical Wire Products	Springfield, N.J.
07910	Continental Device Corp.	Hawthorne, Calif.
07933	Rheem Semiconductor Corp.	Mountain View, Calif.
07966	Shockley Semi-Conductor Laboratories	Palo Alto, Calif.
07980	Boonton Radio Corp.	Boonton, N.J.
08145	U.S. Engineering Co.	Los Angeles, Calif.
08358	Burgess Battery Co.	Niagara Falls, Ontario, Canada.
08717	Sloan Company	Burbank, Calif.
08718	Cannon Electric Co., Phoenix Div.	Phoenix, Ariz.
08792	CBS Electronics Semiconductor Operations, Div. of C.B.S., Inc.	Lowell, Mass.
08984	Mel-Rain	Indianapolis, Ind.
09026	Babcock Relays, Inc.	Costa Mesa, Calif.
09134	Texas Capacitor Co.	Houston, Texas
09250	Electro Assemblies, Inc.	Chicago, Ill.
09569	Mallory Battery Co. of Canada, Ltd.	Toronto, Ontario, Canada
09664	The Bristol Co.	Waterbury, Conn.
10214	General Transistor Western Corp.	Los Angeles, Calif.
10411	Ti-Tal, Inc.	Berkeley, Calif.
10646	Carborundum Co.	Niagara Falls, N.Y.
11236	CTS of Berne, Inc.	Berne, Ind.
11237	Chicago Telephone of California, Inc.	So. Pasadena, Calif.
11312	Microwave Electronics Corp.	Palo Alto, Calif.
11534	Duncan Electronic, Inc.	Santa Ana, Calif.
11711	General Instrument Corporation Semiconductor Division	Newark, N.J.
11717	Imperial Electronic, Inc.	Buena Park, Calif.
11870	Melabs, Inc.	Palo Alto, Calif.
12697	Clarostat Mfg. Co.	Dover, N.H.
12859	Nippon Electric Co., Ltd.	Tokyo, Japan
12930	Delta Semiconductor Inc.	Newport Beach, Calif.
13103	Thermalloy	Dallas, Texas
13396	Telefunken (G.M.B.H.)	Hannover, Germany
14099	Semi-Tech	Newbury Park, Calif.
14193	Calif. Resistor Corp.	Santa Monica, Calif.
14298	American Components, Inc.	Conshohocken, Pa.
14655	Cornell Dubilier Elec. Corp.	So. Plainfield, N.J.
15909	The Daven Co.	Livingston, N.J.
16688	De Jur-Amsco Corporation	Long Island City 1, N.Y.
16758	Delco Radio Div. of G.M. Corp.	Kokomo, Ind.
18873	E.I. DuPont and Co., Inc.	Wilmington, Del.
19315	Eclipse Pioneer, Div. of Bendix Aviation Corp.	Teterboro, N.J.
19500	Thomas A. Edison Industries, Div. of McGraw-Edison Co.	West Orange, N.J.
19701	Electra Manufacturing Co.	Kansas City, Mo.
20183	Electronic Tube Corp.	Philadelphia, Pa.
21226	Executive, Inc.	New York, N.Y.
21520	Fansteel Metallurgical Corp.	No. Chicago, Ill.
21335	The Fafnir Bearing Co.	New Britain, Conn.
21964	Fed. Telephone and Radio Corp.	Clifton, N.J.
24446	General Electric Co.	Schenectady, N.Y.
24455	G.E., Lamp Division	Nela Park, Cleveland, Ohio
24655	General Radio Co.	West Concord, Mass.
26365	Gries Reproducer Corp.	New Rochelle, N.Y.
26462	Grobet File Co. of America, Inc.	Carlstadt, N.J.
26992	Hamilton Watch Co.	Lancaster, Pa.
28480	Hewlett-Packard Co.	Palo Alto, Calif.
33173	G.E. Receiving Tube Dept.	Owensboro, Ky.
35434	Lectrohm Inc.	Chicago, Ill.
37942	P.R. Mallory & Co., Inc.	Indianapolis, Ind.
39543	Mechanical Industries Prod. Co.	Akron, Ohio
40920	Miniature Precision Bearings, Inc.	Keene, N.H.
42190	Muter Co.	Chicago, Ill.
43990	C.A. Norgren Co.	Englewood, Colo.
44655	Ohmite Mfg. Co.	Skokie, Ill.
47904	Polaroid Corp.	Cambridge, Mass.
48620	Precision Thermometer and Inst. Co.	Philadelphia, Pa.
49956	Raytheon Company	Lexington, Mass.
52090	Rowan Controller Co.	Baltimore, Md.
63743	Ward Leonard Electric	Mt. Vernon, N.Y.
64294	Shallcross Mfg. Co.	Selma, N.C.
65026	Simpson Electric Co.	Chicago, Ill.
65933	Sonotone Corp.	Elmsford, N.Y.
65938	Sorenson & Co., Inc.	So. Norwalk, Conn.
66137	Spaulding Fibre Co., Inc.	Tonawanda, N.Y.
66289	Sprague Electric Co.	North Adams, Mass.
69446	Telex, Inc.	St. Paul, Minn.
69730	Thomas & Betts Co.	Elizabeth 1, N.J.
70741	Tripplett Electrical Inc.	Bluffton, Ohio
71775	Union Switch and Signal, Div. of Westinghouse Air Brake Co.	Swissvale, Pa.
72119	Universal Electric Co.	Owosso, Mich.
73743	Ward-Leonard Electric Co.	Mt. Vernon, N.Y.
74959	Western Electric Co., Inc.	New York, N.Y.
75092	Weston Inst. Div. of Daystrom, Inc.	Newark, N.J.
76295	Wittek Manufacturing Co.	Chicago 23, Ill.
76346	Wollensak Optical Co.	Rochester, N.Y.
70276	Allen Mfg. Co.	Hartford, Conn.
70309	Allied Control Co., Inc.	New York, N.Y.
70319	Ailmetal Screw Prod. Co., Inc.	Garden City, N.Y.
70485	Atlantic India Rubber Works, Inc.	Chicago, Ill.
70563	Amperite Co., Inc.	New York, N.Y.
70903	Belden Mfg. Co.	Chicago, Ill.
70998	Bird Electronic Corp.	Cleveland, Ohio
71002	Birnbach Radio Co.	New York, N.Y.
71041	Boston Gear Works Div. of Murray Co. of Texas	Quincy, Mass.
71218	Bud Radio Inc.	Cleveland, Ohio
71286	Camloc Fastener Corp.	Paramus, N.J.
71313	Allen D. Cardwell Electronic Prod. Corp.	Plainville, Conn.
71400	Bussmann Fuse Div. of McGraw-Edison Co.	St. Louis, Mo.
71436	Chicago Condenser Corp.	Chicago, Ill.
71450	CTS Corp.	Elkhart, Ind.
71468	Cannon Electric Co.	Los Angeles, Calif.
71471	Cinema Engineering Co.	Burbank, Calif.
71482	C.P. Clare & Co.	Chicago, Ill.
71590	Centralab Div. of Globe Union Inc.	Milwaukee, Wis.
71700	The Cornish Wire Co.	New York, N.Y.
71744	Chicago Miniature Lamp Works	Chicago, Ill.
71753	A.O. Smith Corp., Crowley Div.	West Orange, N.J.
71785	Cinch Mfg. Corp.	Chicago, Ill.
71984	Dow Corning Corp.	Midland, Mich.
72092	Eitel-McCullough, Inc.	San Bruno, Calif.
72136	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.
71707	Coto Coil Co., Inc.	Providence, R.I.
72354	John E. Fast & Co.	Chicago, Ill.
72619	Dialight Corp.	Brooklyn, N.Y.
72656	General Ceramics Corp.	Keasbey, N.J.
72699	General Instrument Corp., Semiconductor Div.	Newark, N.J.
72758	Girard-Hopkins	Oakland, Calif.
72765	Drake Mfg. Co.	Chicago, Ill.
72825	Hugh H. Eby Inc.	Philadelphia, Pa.
72928	Gudeman Co.	Chicago, Ill.
72964	Robert M. Hadley Co.	Los Angeles, Calif.
72982	Erie Resistor Corp.	Erie, Pa.
73061	Hansen Mfg. Co., Inc.	Princeton, Ind.
73076	H.M. Harper Co.	Chicago, Ill.
73138	Helipot Div. of Beckman Instruments, Inc.	Fullerton, Calif.
73293	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Calif.
73445	Amperex Electronic Co., Div. of North American Phillips Co, Inc.	Hicksville, N.Y.
73490	Beckman Helipot Corp.	So. Pasadena, Calif.
73506	Bradley Semiconductor Corp.	Hamden, Conn.
73559	Carling Electric, Inc.	Hartford, Conn.
73682	George K. Garrett Co., Inc.	Philadelphia, Pa.
73734	Federal Screw Prod. Co.	Chicago, Ill.
73743	Fischer Special Mfg. Co.	Cincinnati, Ohio
73793	The General Industries Co.	Elyria, Ohio
73905	Jennings Radio Mfg. Co.	San Jose, Calif.
74455	J.H. Winns, and Sons	Winchester, Mass.
74861	Industrial Condenser Corp.	Chicago, Ill.
74868	R.F. Products Division of Amphenol-Borg Electronics Corp.	Danbury, Conn.
74970	E.F. Johnson Co.	Waseca, Minn.
75042	International Resistance Co.	Philadelphia, Pa.
75173	Jones, Howard B., Division of Cinch Mfg. Corp.	Chicago, Ill.
75378	James Knights Co.	Sandwich, Ill.
75382	Kulka Electric Corporation	Mt. Vernon, N.Y.
75818	Lenz Electric Mfg. Co.	Chicago, Ill.
75915	Littlefuse Inc.	Des Plaines, Ill.
76005	Lord Mfg. Co.	Erie, Pa.
76210	C.W. Marwedel	San Francisco, Calif.
76433	Micamold Electronic Mfg. Corp.	Brooklyn, N.Y.
76487	James Millen Mfg. Co., Inc.	Malden, Mass.
76493	J.W. Miller Co.	Los Angeles, Calif.
76530	Monadnock Mills	San Leandro, Calif.
76545	Mueller Electric Co.	Cleveland, Ohio.
76854	Oak Manufacturing Co.	Crystal Lake, Ill.
77068	Bendix Pacific Division of Bendix Corp.	No. Hollywood, Calif.
77075	Pacific Metals Co.	San Francisco, Calif.
77221	Phaostron Instrument and Electronic Co.	South Pasadena, Calif.
77250	Phoeli Mfg. Co.	Chicago, Ill.
77252	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.
77342	Potter and Brumfield, Div. of American Machine and Foundry	Princeton, Ind.
77630	Radio Condenser Co.	Camden, N.J.
77638	Radio Receptor Co., Inc.	Brooklyn, N.Y.
77764	Resistance Products Co.	Harrisburg, Pa.
78189	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
78283	Signal Indicator Corp.	New York, N.Y.
78290	Struthers-Dunn Inc.	Pitman, N.J.
78452	Thompson-Bremer & Co.	Chicago, Ill.
78471	Tilley Mfg. Co.	San Francisco, Calif.
78488	Stackpole Carbon Co.	St. Marys, Pa.
78493	Standard Thomson Corp.	Waltham, Mass.
78553	Tinnerman Products, Inc.	Cleveland, Ohio
78790	Transformer Engineers	Pasadena, Calif.
78947	Ucinite Co.	Newtonville, Mass.
79142	Veeder Root, Inc.	Hartford, Conn.
79251	Wenco Mfg. Co.	Chicago, Ill.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Corp.	New Rochelle, N.Y.
80031	Mepco Division of Sessions Clock Co.	Morristown, N.J.
80120	Schnitzer Alloy Products	Elizabeth, N.J.
80130	Times Facsimile Corp.	New York, N.Y.
80131	Electronic Industries Association. Any brand tube meeting EIA standards	Washington, D.C.
80207	Unimax Switch, Div. of W.L. Maxson Corp.	Wallingford, Conn.
80223	United Transformer Corp.	New York, N.Y.
80248	Oxford Electric Corp.	Chicago, Ill.
80294	Bourns Laboratories, Inc.	Riverside, Calif.
80411	Acro Div. of Robertshaw Fulton Controls Co.	Columbus 16, Ohio
80486	All Star Products Inc.	Defiance, Ohio
80583	Hammerland Co., Inc.	New York, N.Y.
80640	Stevens, Arnold, Co., Inc.	Boston, Mass.
81030	International Instruments, Inc.	New Haven, Conn.
81073	Grayhill Co.	LaGrange, Ill.
81095	Triad Transformer Corp.	Venice, Calif.
81312	Winchester Electronics Co., Inc.	Norwalk, Conn.
81349	Military Specification	.....
81415	Wilkor Products, Inc.	Cleveland, Ohio
81453	Raytheon Mfg. Co., Industrial Components Div., Industr. Tube Operations	Newton, Mass.
81483	International Rectifier Corp.	El Segundo, Calif.
81541	The Airpax Products Co.	Cambridge, Mass.
81860	Barry Controls, Inc.	Watertown, Mass.
82042	Carter Parts Co.	Skokie, Ill.
82142	Jeffers Electronics Division of Speer Carbon Co.	Du Bois, Pa.
82170	Allen B. DuMont Labs, Inc.	Clifton, N.J.

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Table 6-3. Code List of Manufacturers (Sheet 2 of 2)

Code No.	Manufacturer	Address
82209	Maguire Industries, Inc.	Greenwich, Conn.
82219	Sylvania Electric Prod. Inc. Electronic Tube Div.	Emporium, Pa.
82376	Astron Co.	East Newark, N.J.
82389	Switchcraft, Inc.	Chicago, Ill.
82647	Metals and Controls, Inc., Div. of Texas Instruments, Inc., Spencer Prods.	Attleboro, Mass.
82866	Research Products Corp.	Madison, Wis.
82877	Rotron Manufacturing Co., Inc.	Woodstock, N.Y.
82893	Vector Electronic Co.	Glendale, Calif.
83053	Western Washer Mfr. Co.	Los Angeles, Calif.
83058	Carr Fastener Co.	Cambridge, Mass.
83086	New Hampshire Ball Bearing, Inc.	Peterborough, N.H.
83125	Pyramid Electric Co.	Darlington, S.C.
83148	Electro Cords Co.	Los Angeles, Calif.
83186	Victory Engineering Corp.	Union, N.J.
83298	Bendix Corp., Red Bank Div.	Red Bank, N.J.
83315	Hubbell Corp.	Mundelein, Ill.
83330	Smith, Herman H., Inc.	Brooklyn, N.Y.
83385	Central Screw Co.	Chicago, Ill.
83501	Gavitt Wire and Cable Co., Div. of Amerace Corp.	Brookfield, Mass.
83594	Burroughs Corp., Electronic Tube Div.	Plainfield, N.J.
83740	Eveready Battery	New York, N.Y.
83777	Model Eng. and Mfg., Inc.	Huntington, Ind.
83821	Loyd Scruggs Co.	Festus, Mo.
84171	Arco Electronis, Inc.	New York, N.Y.
84396	A.J. Glesener Co., Inc.	San Francisco, Calif.
84411	Good All Electric Mfg. Co.	Ogallala, Neb.
84970	Sarkes Tarzian, Inc.	Bloomington, Ind.
85454	Boonton Molding Company	Boonton, N.J.
85471	A.B. Boyd Co.	San Francisco, Calif.
85474	R.M. Bracamonte & Co.	San Francisco, Calif.
85660	Koiled Kords, Inc.	New Haven, Conn.
85911	Seamless Rubber Co.	Chicago, Ill.
86197	Clifton Precision Products	Clifton Heights, Pa.
86579	Precision Rubber Products Corp.	Dayton, Ohio
86684	Radio Corp. of America, RCA Electron Tube Div.	Harrison, N.J.
87216	Philco Corporation (Lansdale Division)	Lansdale, Pa.
87473	Western Fibrous Glass Products Co.	San Francisco, Calif.
87664	Van Waters & Rogers Inc.	Seattle, Wash.
88140	Cutler-Hammer, Inc.	Lincoln, Ill.
88220	Gould-National Batteries, Inc.	St. Paul, Minn.
88698	General Mills, Inc.	Buffalo, N.Y.
89473	General Electric Distributing Corp.	Schenectady, N.Y.
89636	Carter Parts Div. of Economy Baler Co.	Chicago, Ill.
89665	United Transformer Co.	Chicago, Ill.
90179	U.S. Rubber Co., Mechanical Goods Div.	Passaic, N.J.
90970	Bearing Engineering Co.	San Francisco, Calif.
91260	Connor Spring Mfg. Co.	San Francisco, Calif.
91345	Miller Dial & Nameplate Co.	El Monte, Calif.
91418	Radio Materials Co.	Chicago, Ill.
91506	Augat Brothers', Inc.	Attleboro, Mass.
91637	Dale Electronics, Inc.	Columbus, Nebr.
91662	Elco Corp.	Philadelphia, Pa.
91737	Gremar Mfg. Co., Inc.	Wakefield, Mass.
91827	K F Development Co.	Redwood City, Calif.
91929	Minneapolis-Honeywell Regulator Co., Microswitch Div.	Freeport, Ill.
92196	Universal Metal Prod., Inc.	Bassett Puente, Calif.
92367	Elgeet Optical Co., Inc.	Rochester, N.Y.
92607	Timsolite Insulated Wire Co.	Tarrytown, N.Y.
93332	Sylvania Electric Prod. Inc., Semiconductor Div.	Woburn, Mass.
93369	Robbins and Myers, Inc.	New York, N.Y.
93410	Stevens Mfg. Co., Inc.	Mansfield, Ohio
93983	Inseline-Van Norman Ind., Inc. Electronic Division	Manchester, N.H.
94144	Raytheon Mfg. Co., Industrial Components Div., Receiving Tube Operation	Quincy, Mass.
94145	Raytheon Mfg. Co., Semiconductor Div., California Street Plant	Newton, Mass.
94148	Scientific Radio Products, Inc.	Loveland, Colo.
94154	Tung-Sol Electric, Inc.	Newark, N.J.
94197	Curtiss-Wright Corp., Electronics Div.	East Paterson, N.J.
94310	Tru Ohm Prod. Div. of Model Engineering and Mfg. Co.	Chicago, Ill.
94682	Worcester Pressed Aluminum Corp.	Worcester, Mass.
95023	Philbrick Researchers, Inc.	Boston, Mass.
95236	Allies Products Corp.	Miami, Fla.
95238	Continental Connector Corp.	Woodside, N.Y.
95263	Leecraft Mfg. Co., Inc.	New York, N.Y.
95264	Lerco Electronics, Inc.	Burbank, Calif.
95265	National Coil Co.	Sheridan, Wyo.
95275	Vitramon, Inc.	Bridgeport, Conn.
95348	Gordas Corp.	Bloomfield, N.J.
95354	Methode Mfg. Co.	Chicago, Ill.
95987	Weckesser Co.	Chicago, Ill.
96067	Huggins Laboratories	Sunnyvale, Calif.
96095	Hi-Q Division of Aerovox	Olean, N.Y.
96256	Thordarson-Meissner Div. of Maguire Industries, Inc.	Mt. Carmel, Ill.
96296	Solar Manufacturing Co.	Los Angeles, Calif.
96330	Carlton Screw Co.	Chicago, Ill.
96341	Microwave Associates, Inc.	Burlington, Mass.
96501	Excel Transformer Co.	Oakland, Calif.
97464	Industrial Retaining Ring Co.	Irvington, N.J.
97539	Automatic and Precision Mfg. Co.	Yonkers, N.Y.
97966	CBS Electronics, Div. of C.B.S., Inc.	Danvers, Mass.
97979	Reon Resistor Corp.	Yonkers, N.Y.
98141	Axel Brothers Inc.	Jamaica, N.Y.
98159	Rubber Teck, Inc.	Gardena, Calif.
98220	Francis L. Mosley	Pasadena, Calif.
98278	Microdot, Inc.	So. Pasadena, Calif.
98291	Sealectro Corp.	Mamaroneck, N.Y.
98405	Carad Corp.	Redwood City, Calif.
98731	General Mills	Minneapolis, Minn.
98821	North Hills Electric Co.	Mineola, N.Y.
98925	Clevite Transistor Prod. Div. of Clevite Corp.	Waltham, Mass.
98978	International Electronic Research Corp.	Burbank, Calif.
99109	Columbia Technical Corp.	New York, N.Y.
99313	Varian Associates	Palo Alto, Calif.
99515	Marshall Industries, Electron Products Division	Pasadena, Calif.
99707	Control Switch Division, Controls Co. of America	El Segundo, Calif.
99800	Delevan Electronics Corp.	East Aurora, N.Y.
99848	Wilco Corporation	Indianapolis, Ind.
99934	Reebrandt, Inc.	Boston, Mass.
99942	Hoffman Semiconductor Div. of Hoffman Electronics Corp.	Evanston, Ill.
99957	Technology Instrument Corp of Calif.	Newbury Park, Calif.

Code No.	Manufacturer	Address
THE FOLLOWING H-P VENDORS HAVE NO NUMBER ASSIGNED IN THE LATEST SUPPLEMENT TO THE FEDERAL SUPPLY CODE FOR MANUFACTURERS HANDBOOK.		
00000	JFD Electronics Corp.	Van Nuys, Calif.
00000	Tranex Company	Mountain View, Calif.
00000	Western Devices, Inc.	Inglewood, Calif.
00000	Winchester Electronics, Inc.	Santa Monica, Calif.
0000F	Malco Tool and Die	Los Angeles, Calif.
0000M	Western Coil Div. of Automatic Ind., Inc.	Redwood City, Calif.
0000N	Nahm-Bros. Spring Co.	San Leandro, Calif.
00000	U.S.A. Common	Any supplier of U.S.
0000P	Ty-Car Mfg. Co., Inc.	Holliston, Mass.
0000T	Texas Instruments, Inc. Metals and Controls Div.	Versailles, Ky.
0000U	Tower Mfg. Corp.	Providence, R.I.
0000W	Webster Electronics Co. Inc.	New York, N.Y.
0000X	Spruce Pine Mica Co.	Spruce Pine, N.C.
0000Y	Midland Mfg. Co. Inc.	Kansas City, Kans.
0000Z	Willow Leather Products Corp.	Newark, N.J.
000AA	British Radio Electronics Ltd.	Washington, D.C.
000AB	ETA	England
000AC	Indiana General Corp., Elect. Div.	Indiana
000AD	Curtis Instrument Inc.	Mt. Kisco, N.Y.
000BB	Precision Instrument Components Co.	Van Nuys, Calif.
000CC	Computer Diode Corp.	Lodi, N.J.
000EE	A. Williams Manufacturing Co.	San Jose, Calif.
000GG	Goshen Die Cutting Service	Goshen, Ind.
000HH	Rubbercraft Corp.	Torrance, Calif.
000II	Birtcher Corporation, Industrial Division	Monterey Park, Calif.
000KK	Amatom	New Rochelle, N.Y.
000LL	Avery Label	Monrovia, Calif.
000MM	Rubber Eng. & Development	Hayward, Calif.
000NN	A "N" O Manufacturing Co.	San Jose 27, Calif.
000PP	Atohm Electronics	Sun Valley, Calif.
000QQ	Cooltron	Oakland, Calif.
000RR	Radio Industries	Des Plaines, Ill.
000SS	Control of Elgin Watch Co.	Burbank, Calif.
000WW	California Eastern Lab.	Burlingame, Calif.
000XX	Methode Electronics, Inc.	Chicago 31, Ill.
000YY	S.K. Smith Co.	Los Angeles 45, Calif.

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APPENDIX I — MANUAL CHANGES

This manual applies directly to the 5245L Electronic Counters having serial number prefix 409. This manual with the following changes also applies to 5245L Electronic Counters having serial prefix numbers 402, 335, 328, 322, 316, 307, 305, 249, and 232.

To adapt this manual to instruments with serial number prefixes other than 408, make changes as follows:

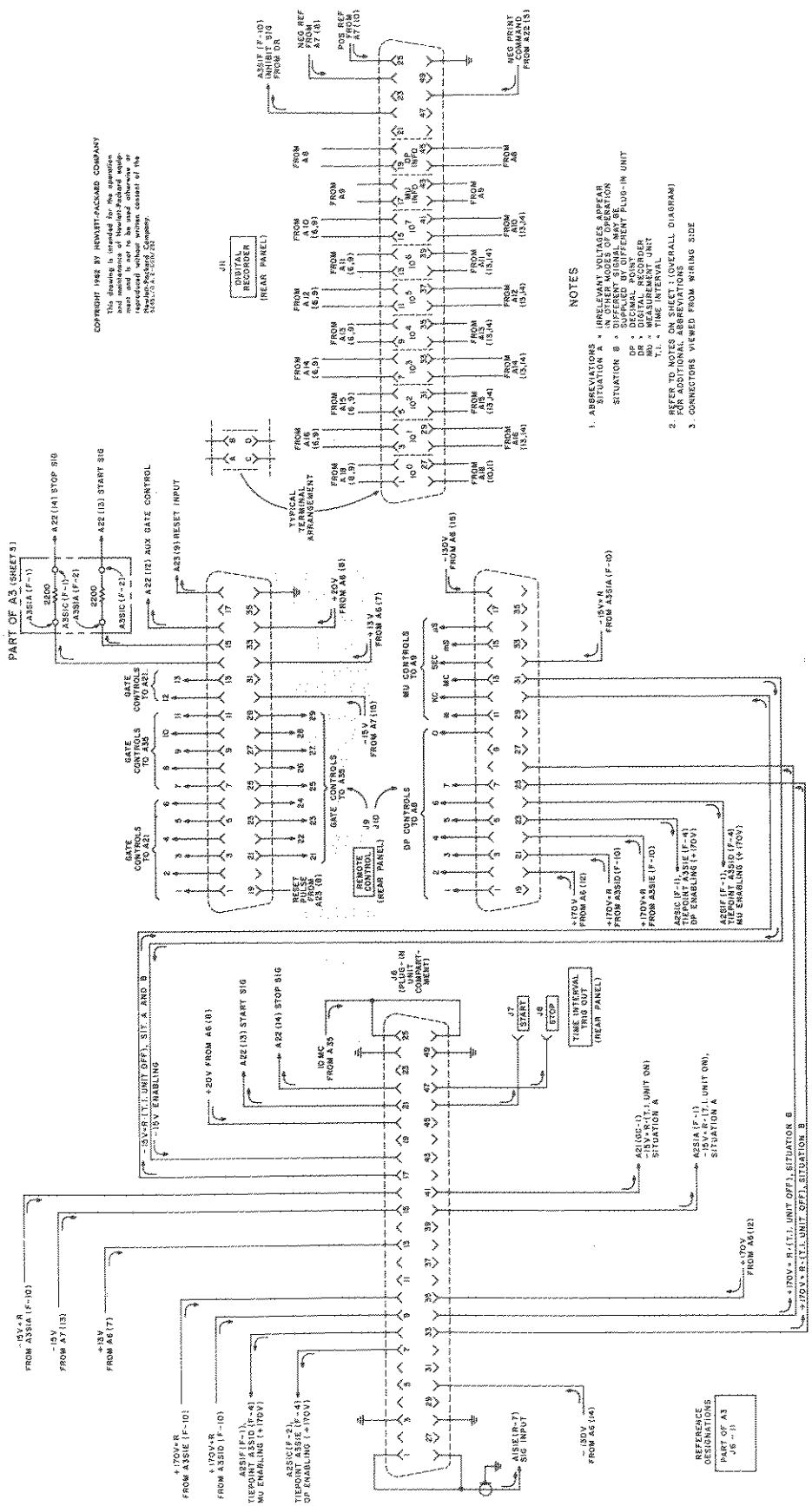
Instrument Serial No. Prefix	Change No.
402	1
335 - 00876 and above	1, 2
335 - 00875 and below	1 thru 3
328	1, 2, 4
322	1, 2, 4, 5
316	1, 2, 4 thru 6
307	1, 2, 4 thru 7
305	1, 2, 4 thru 8
249	1, 2, 4 thru 9
232	1, 2, 4 thru 10

CHANGE 1:

Figure 5-17, A9:	C1 - delete
Tables 6-1, 6-2:	A9C1 - 0150-0012 - delete

CHANGE 2:

Figure 5-7, A1:	A1S1C - delete connections to terminals 6 and 7. Delete C14 and A1R4.
Figure 5-19, A10 thru A14:	C2 - change to 110 pf
Figure 5-23, A17:	C13 (Pin 9 of A17 to ground) - delete C15 (Pin 2 to Pin 6 of A17) - delete
Figure 5-31, A22:	R38 (Pin 8 to Pin 10 on A22) - delete
Figure 5-32, A23:	C9, C10, CR9, R35 - delete C2 - change to 470 pf Q6 - change to 1850-0062 R10 - change to 5600 R11 - change to 27K R14 - change to 3000
Figure 5-35, A25:	Q2 - change to 2N652A R10 - change to 820
Figure 5-44, J6, J9, J10, J11:	Use Figure 1A1.
Tables 6-1, 6-2:	A1R4 - 0683-2245 - delete A10C2: change to: 0140-0194, C: fxd, mica, 110 pf, 5%, 300 vdcw A22R38 - 0683-7525 - delete A23C9 - 0160-0161 - delete A23C10 - 0140-0152 - delete A23CR9 - 1901-0040 - delete A23R35 - 0686-4715 - delete A23C2 - change to: 0140-0149, C: fxd, mica, 470 pf, 5%, 300 vdcw A23Q6 - change to: 0150-0062 , Transistor: Ge A23R10 - change to: 0686-5625, R: fxd, comp, 5.6K ohm, 5%, 1/2W A23R11 - change to: 0686-2735 R: fxd, comp, 27K ohm, 5%, 1/2W


PART OF A3 (SHEET 3)
A22 (12) AUX GATE CONTROL
A22 (13) START SIG
A22 (14) STOP SIG
A23 (9) RESET INPUT
+20V FROM A6 (8)
+13V FROM A6 (7)
-130V FROM A6 (15)
-15V+R FROM A3IA (F-10)
GATE CONTROLS TO A21
GATE CONTROLS TO A35
GATE CONTROLS TO A36
DP CONTROLS TO A8
MU CONTROLS TO A9
REMOTE CONTROL (REAR PANEL)
RESET FROM A23 (8)
+15V FROM A7 (15)
J9
J10
J1
DIGITAL RECORDER (REAR PANEL)
TYPICAL TERMINAL ARRANGEMENT
A3IIF (F-10) INHIBIT SIG FROM DR
NEG REF FROM A7 (8)
POS REF FROM A7 (10)
NEG PRINT COMMAND FROM A22 (3)
NOTES
1. ABBREVIATIONS
SITUATION A = UNRELEVANT VOLTAGES APPEAR
SITUATION B = UNDER NORMAL INSTRUMENT OPERATION
SUPPLIED BY DIFFERENT PLUG-IN UNIT
DP = DECIMAL POINT
DR = DIGITAL RECORDER
MU = MEASUREMENT UNIT
T.I. = TIME INTERVAL
2. REFER TO NOTES ON SHEET 1 (OVERALL DIAGRAM) FOR ADDITIONAL ABBREVIATIONS
3. CONNECTORS VIEWED FROM WIRING SIDE
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-15V+R FROM A3IA (F-10)
-13V FROM A7 (15)
+13V FROM A6 (7)
+170V+R FROM A3IE (F-10)
+170V+R FROM A3IG (F-10)
A20IF (F-1) TIEPOINT A3IG (F-4) MU ENABLING (+170V)
A23IC (F-2) TIEPOINT A3IE (F-4) DP ENABLING (+170V)
A3IE (R-7) SIG INPUT
-130V FROM A6 (14)
+170V FROM A6 (12)
+170V+R (T.I. UNIT OFF), SIT. A, AND B
-15V ENABLING
+20V FROM A6 (8)
A22 (13) START SIG
A22 (14) STOP SIG
10 MC FROM A35
J6 (PLUG-IN UNIT COMPARTMENT)
J7 START
J8 STOP
TIME INTERVAL TRIG OUT (REAR PANEL)
A21 (GC-1) -15V+R (T.I. UNIT ON) SITUATION A
A23IA (F-1) -15V+R (T.I. UNIT ON), SITUATION A
+170V+R (T.I. UNIT OFF), SITUATION B
REFERENCE DESIGNATIONS
PART OF A3 J6 -- 1)

Figure IA-1

CHANGE 2: (cont'd)

A23R14 - change to: 0686-3025
R: fxd, comp, 3K ohm, 5%, 1/2W
A25Q2 - change to 1850-0054,
Transistor: 2N652A
A25R10 - change to: 0683-8215
R: fxd, comp, 820 ohm, 5%, 1/4W
C13 - 0150-0121 - delete
C14 - 0150-0012 - delete
C15 - 0160-0127 - delete

CHANGE 3:

Figure 5-25, A18:

R22 - change to 91 ohms

Tables 6-1, 6-2:

A18R22 - change to 0683-9105
R: fxd, comp, 91 ohms, 5%, 1/4W

CHANGE 4:

Figure 5-25, A18:

Q1 thru Q8 - change to 1851-0024
R18, R26, R34, R42 - change to 1000 ohms
R21, R29, R37, R45 - change to 1500 ohms
R22, R30, R38, R46 - change to 180 ohms
R20, R28, R36, R44 - change to 43K ohms

Tables 6-1, 6-2:

A18Q1 thru Q8 - change to 1851-0024,
Transistor: Ge 21V388A
A18R18, R26, R34, R42 - change to 0683-1025
R: fxd, comp, 1K ohms, 5%, 1/4W
A18R21, R29, R37, R45 - change to 0683-1525
R: fxd, comp, 1.5K ohms, 5%, 1/4W
A18R22, R30, R38, R46 - change to 0683-1815
R: fxd, comp, 180 ohms, 5%, 1/4W
A18R20, R28, R36, R44 - change to 0683-4335
R: fxd, comp, 43K ohms, 5%, 1/4W

CHANGE 5:

Figure 5-15, A6:
Figure 5-27, A19, A20:

CR1 thru CR16 - change to 1901-0029
R13 - delete

Tables 6-1, 6-2:

A6CR1 thru CR16 - change to 1901-0029
Diode, Si: 600V, PIV, 1N3194
A19R13 - 0686-6215 - delete

CHANGE 6:

Figure 5-32, A23:

R10 - change to 10K ohms
R11 - change to 47K ohms

Tables 6-1, 6-2:

A23R10 - change to 0686-1035
R: fxd, comp, 10K ohms, 5%, 1/2W
A23R11 - change to 0686-4735
R: fxd, comp, 47K ohms, 5%, 1/2W

CHANGE 7:

Figure 5-23, A17:

C21 - change to 56 pf
R52 - change to 270 ohms

Figure 5-32, A23:

Q8 - change to 2N1672

CHANGE 7: (Cont'd)

Figure 5-35, A25: Change A25 to appear as shown on partial schematic:

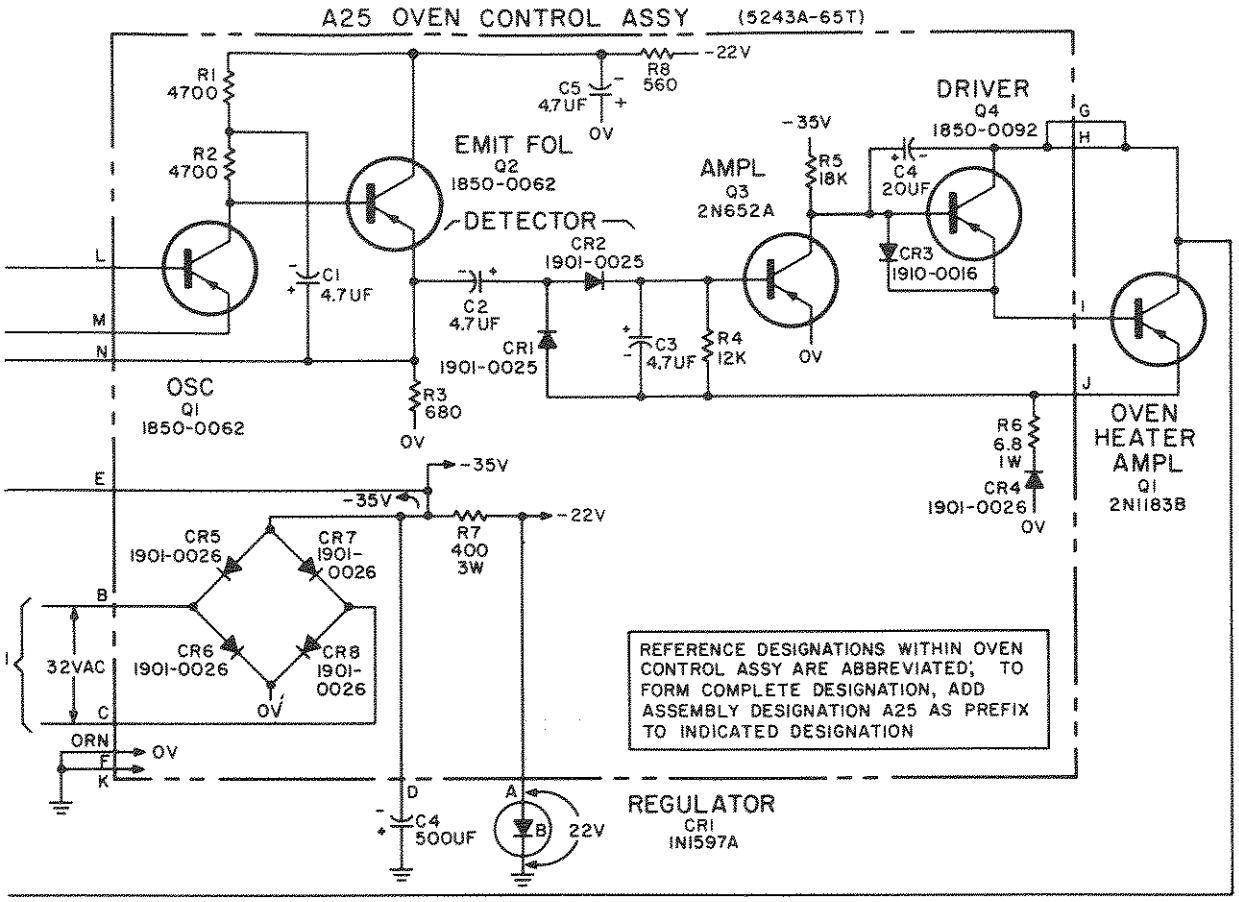


Figure 5-35, A25:

Q4 - change to 1850-0092
R1, R2 - change to 4700 ohms
R3 - change to 680 ohms
R8 - change to 560 ohms
C6 - delete
C7 - delete
R9 - delete
R10 - delete

Tables 6-1, 6-2:

A17C21 - change to 0140-0191
C: fxd, mica, 56 pf, 5%, 300 vdcw
A17R52 - change to 0683-2715
A23Q8 - change to 1851-0022, Transistor: 2N1672
A25C6 - 0170-0024 - delete
A25C7 - 0180-0100 - delete
A25Q4 - change to 1850-0092, Transistor: 2N2043A
A25R1, R2 - change to 0683-4725
R: fxd, comp, 4.7K ohms, 5%, 1/4W
A25R3 - change to 0683-6815
R: fxd, comp, 680 ohms, 5%, 1/4W
A25R8 - change to 0683-5615
R: fxd, comp, 560 ohms, 5%, 1/4W
A25R9 - 0683-2205 - delete
A25R10 - 0683-8215 - delete

CHANGE 8:

Figure 5-35, A26:	R33 - change to 10K ohms R34 - change to 1200 ohms
Tables 6-1, 6-2:	A26R33 - change to 0683-1035, R: fxd, comp, 10K ohms, 5%, 1/4W A26R34 - change to 0683-1225, R: fxd, comp, 1200 ohms, 5%, 1/4W

CHANGE 9:

Figure 5-35, A25:	Q1, Q2 - change to 1850-0062
Tables 6-1, 6-2:	A25Q1, Q2 - change to 1850-0062, Transistor: Ge

CHANGE 10:

Substitute Figure IA2, and IA3 for Figure 5-21; Tables IA1 and IA2 are parts lists for Figures IA2 and IA3 respectively.
Substitute Figure IA4 for Figure 5-39. Table IA3 is the parts list for Figure IA4.

Figure 5-29, A21:	R23 - change to 36 ohms
Figure 5-35, A26:	Change A26 to appear as shown on partial schematic:

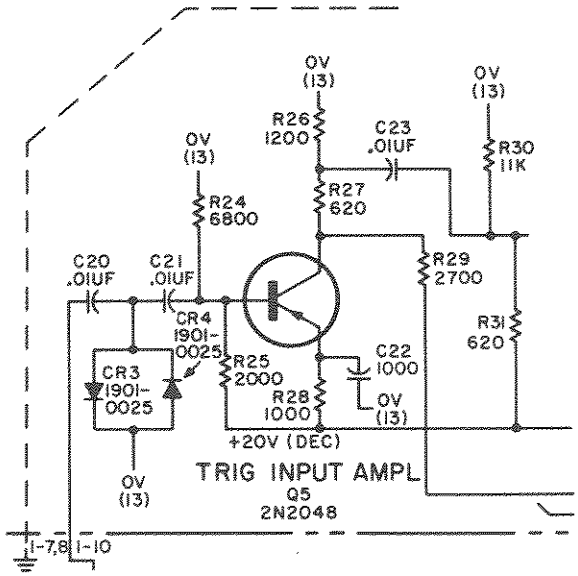


Figure 5-35, A26:	C21 - add 0150-0093, C: fxd, cer. 0.01μf +80%-20%, 100 vdcw C27 - 0140-0202 - delete CR3, CR4 - add 1901-0025 CR5 - 1901-0025 - delete
Tables 6-1, 6-2	A21R23 - change to 0683-3605; R: fxd, comp, 36 ohms, 5%, 1/4W A26C21 - add 0150-0093, C: fxd, cer, 0.01μf +80%-20%, 100 vdcw A26C27 - 0140-0202 - delete A26CR3, CR4 - add 1901-0025, Diode, Si: 50 ma @ +1V, 100 PIV A26CR5 - 1901-0025 - delete

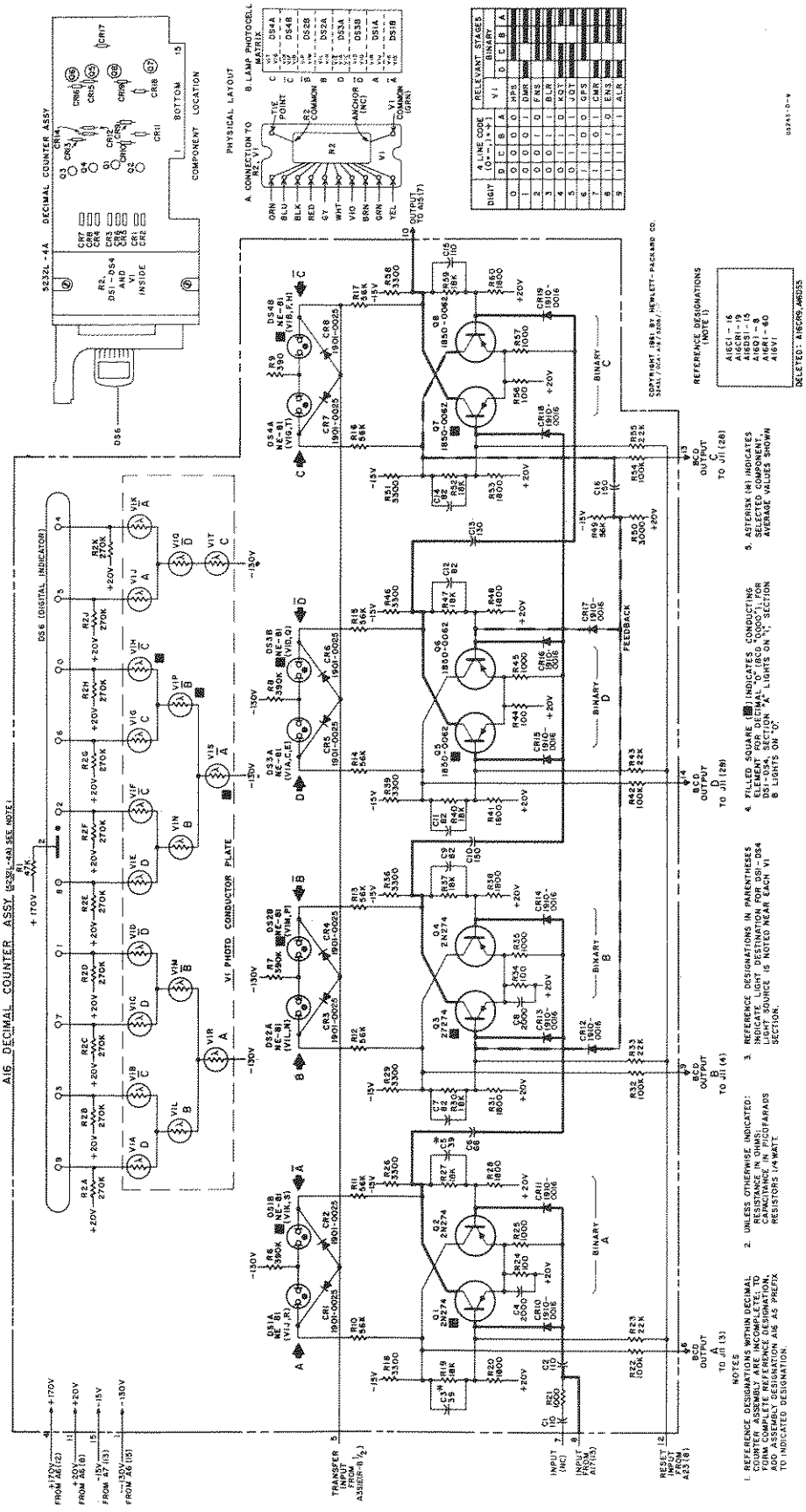


Figure IA-2

Table IA-1. Decimal Counter Assy 5232L-4A (designations prefixed A15)

Circuit Reference	ⓗ Stock No.	Description #	Note
C1, 2	0140-0176	C: fxd, mica, 100 pf ±5%, 300 vdcw	
C3	0140-0190	C: fxd, mica, 39 pf ±5%, 300 vdcw	
C4	0150-0122	C: fxd, cer, 2000 pf ±20%, 500 vdcw	
C5	0140-0191	C: fxd, mica, 56 pf ±5%, 300 vdcw	
C6	0140-0176	C: fxd, mica, 100 pf ±5%, 300 vdcw	
C7	0140-0193	C: fxd, mica, 82 pf ±5%, 300 vdcw	
C8	0150-0122	C: fxd, cer, 2000 pf ±20%, 500 vdcw	
C9	0140-0193	C: fxd, mica, 82 pf ±5%, 300 vdcw	
C10	0140-0217	C: fxd, mica, 140 pf ±5%, 300 vdcw	
C11, 12	0140-0176	C: fxd, mica, 100 pf ±5%, 300 vdcw	
C13	0140-0195	C: fxd, mica, 130 pf ±5%, 300 vdcw	
C14	0140-0176	C: fxd, mica, 100 pf ±5%, 300 vdcw	
C15	0140-0147	C: fxd, mica, 180 pf ±5%, 300 vdcw	
C16	0140-0194	C: fxd, mica, 110 pf ±5%, 300 vdcw	
CR1 thru CR8	1901-0025	Diode, Si: 50 ma @+1V, 100 PIV	
CR10 thru CR19	1910-0016	Diode, Ge: 100 ma @ +1V, 60 PIV	
DS6	1970-0009	Tube, digital indicator "Nixie": 10 digit	
Q1 thru Q4	1850-0037	Transistor: 2N274	
Q5 thru Q8	1850-0062	Transistor: Ge	
R1	0686-4735	R: fxd, comp, 47K ohms ±5%, 1/2 W	
R2		Resistive network (includes 10 resistors) 270K ohms ±20%, 1/4 W	a
R3 thru R5		Not assigned	
R6 thru R9	0683-3945	R: fxd, comp, 390K ohms ±5%, 1/4 W	
R10 thru R17	0683-5635	R: fxd, comp, 56K ohms ±5%, 1/4 W	
R18	0758-0010	R: fxd, metallic oxide, 3.3K ohms ±5%, 1/2 W	
R19	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R20	0683-1825	R: fxd, comp, 1.8K ohms ±5%, 1/4 W	
R21	0683-9115	R: fxd, comp, 910 ohms ±5%, 1/4 W	
R22	0683-1045	R: fxd, comp, 100K ohms ±5%, 1/4 W	
R23	0683-2235	R: fxd, comp, 22K ohms ±5%, 1/4 W	
R24	0683-1015	R: fxd, comp, 100 ohms ±5%, 1/4 W	
R25	0683-1025	R: fxd, comp, 1K ohms ±5%, 1/4 W	
R26	0758-0010	R: fxd, metallic oxide, 3.3K ohms ±5%, 1/2 W	
R27	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R28	0683-1825	R: fxd, comp, 1.8K ohms ±5%, 1/4 W	
R29	0758-0010	R: fxd, metallic oxide, 3.3K ohms ±5%, 1/2 W	
R30	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R31	0683-1825	R: fxd, comp, 1.8K ohms ±5%, 1/4 W	
R32	0683-1045	R: fxd, comp, 100K ohms ±5%, 1/4 W	
R33	0683-2235	R: fxd, comp, 22K ohms ±5%, 1/4 W	
R34	0683-1015	R: fxd, comp, 100 ohms ±5%, 1/4 W	
R35	0683-1025	R: fxd, comp, 1K ohms ±5%, 1/4 W	
R36	0758-0010	R: fxd, metallic oxide, 3.3K ohms ±5%, 1/2 W	

See introduction to this section

Table IA-1. Decimal Counter Assy 5232L-4A (designations prefixed A15) cont'd

Circuit Reference	ⓗp Stock No.	Description	Note
R37	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R38	0683-1825	R: fxd, comp, 1.8K ohms ±5%, 1/4 W	
R39	0758-0010	R: fxd, metallic oxide, 3.3K ohms ±5%, 1/2 W	
R40	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R41	0683-1825	R: fxd, comp, 1.8K ohms ±5%, 1/4 W	
R42	0683-1045	R: fxd, comp, 100K ohms ±5%, 1/4 W	
R43	0683-2235	R: fxd, comp, 22K ohms ±5%, 1/4 W	
R44	0683-1015	R: fxd, comp, 100 ohms ±5%, 1/4 W	
R45	0683-1025	R: fxd, comp, 1K ohms ±5%, 1/4 W	
R46	0758-0010	R: fxd, metallic oxide, 3.3K ohms ±5%, 1/2 W	
R47	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R48	0683-1825	R: fxd, comp, 1.8K ohms ±5%, 1/4 W	
R49	0683-5635	R: fxd, comp, 56K ohms ±5%, 1/4 W	
R50	0683-3025	R: fxd, comp, 3K ohms ±5%, 1/4 W	
R51	0758-0010	R: fxd, metallic oxide, 3.3K ohms ±5%, 1/2 W	
R52	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R53	0683-1825	R: fxd, comp, 1.8K ohms ±5%, 1/4 W	
R54	0683-1045	R: fxd, comp, 100K ohms ±5%, 1/4 W	
R55	0683-2235	R: fxd, comp, 22K ohms ±5%, 1/4 W	
R56	0683-1015	R: fxd, comp, 100 ohms ±5%, 1/4 W	
R57	0683-1025	R: fxd, comp, 1K ohms ±5%, 1/4 W	
R58	0758-0010	R: fxd, metallic oxide, 3.3K ohms ±5%, 1/2 W	
R59	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R60	0683-1825	R: fxd, comp, 1.8K ohms ±5%, 1/4 W	
R61	0683-6805	R: fxd, comp, 68 ohms ±5%, 1/4 W	
R62	0683-6805	R: fxd, comp, 68 ohms ±5%, 1/4 W	
R63	0683-4705	R: fxd, comp, 47 ohms ±5%, 1/4 W	
R64	0683-4705	R: fxd, comp, 47 ohms ±5%, 1/4 W	
R65	0683-4705	R: fxd, comp, 47 ohms ±5%, 1/4 W	
R66	0683-4705	R: fxd, comp, 47 ohms ±5%, 1/4 W	
V1		Plate, photoconductor	a

a. Not field replaceable

See introduction to this section

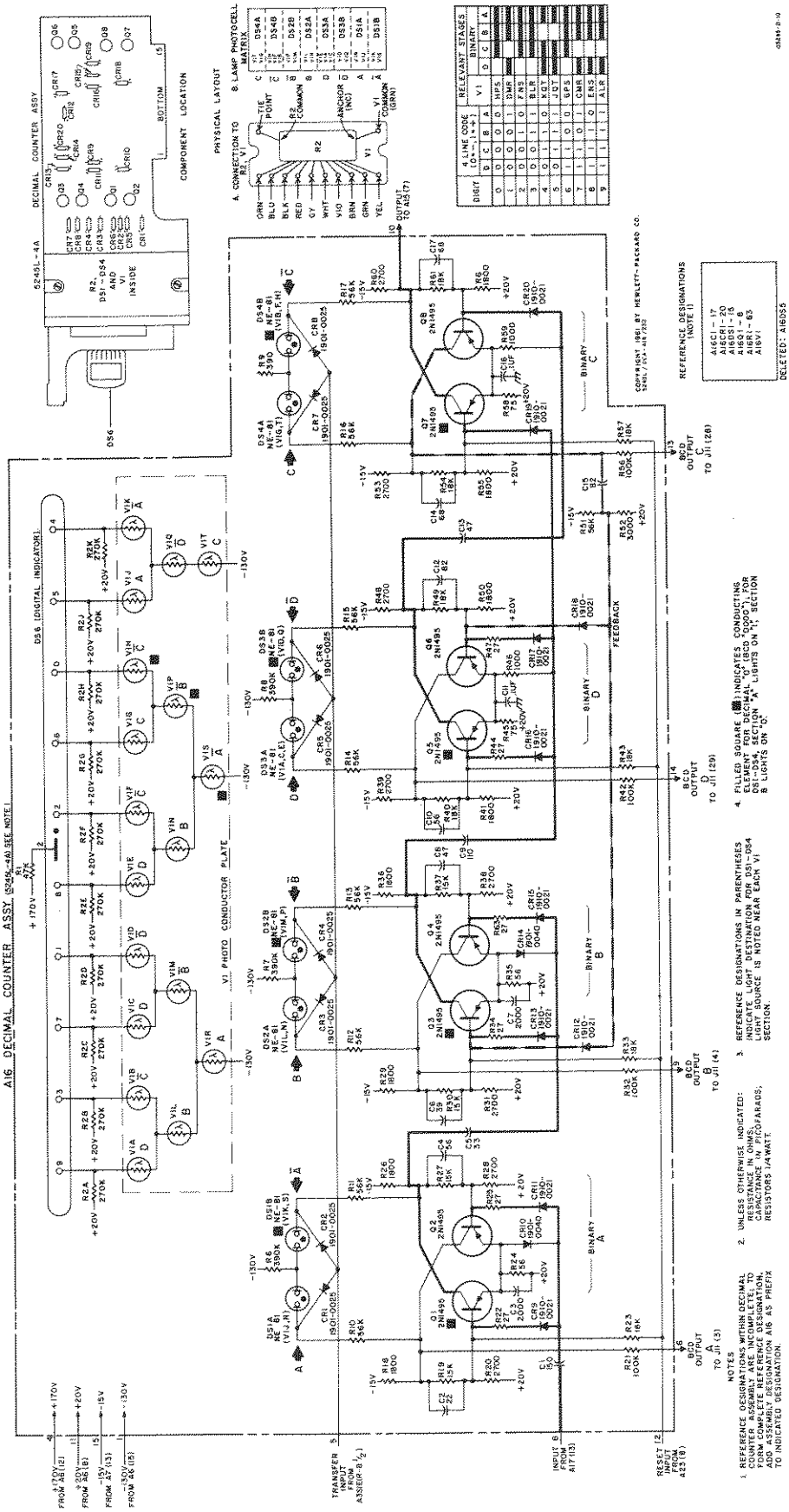


Figure IA-3

Table IA-2. Decimal Counter Assy (designations prefixed A16)

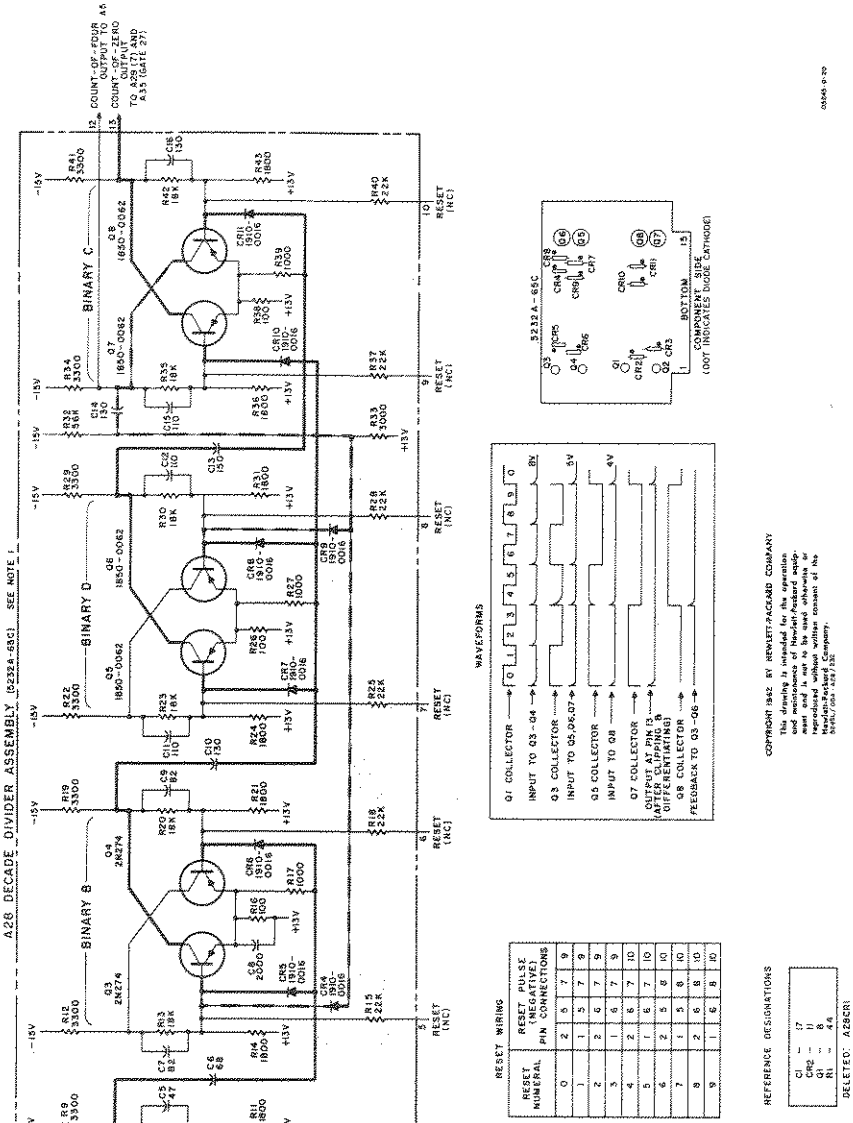
Circuit Reference	℗ Stock No.	Description #	Note
C1	0140-0196	C: fxd, mica, 150 pf ±5%, 300 vdcw	
C2	0140-0145	C: fxd, mica, 22 pf ±5%, 500 vdcw	
C3	0150-0121	C: fxd, cer, 0.1 uf +80% -20%, 50 vdcw	
C4	0140-0191	C: fxd, mica, 56 pf ±5%, 300 vdcw	
C5	0160-0179	C: fxd, mica, 33 pf ±5%, 300 vdcw	
C6	0140-0190	C: fxd, mica, 39 pf ±5%, 300 vdcw	
C7	0150-0121	C: fxd, cer, 0.1 uf +80% -20%, 50 vdcw	
C8	0140-0204	C: fxd, mica, 47 pf ±5%, 500 vdcw	
C9	0140-0194	C: fxd, mica, 110 pf ±5%, 300 vdcw	
C10	0140-0191	C: fxd, mica, 56 pf ±5%, 300 vdcw	
C11	0150-0121	C: fxd, cer, 0.1 uf +80% - 20%, 50 vdcw	
C12	0140-0193	C: fxd, mica, 82 pf ±5%, 300 vdcw	
C13	0140-0204	C: fxd, mica, 47 pf ±5%, 500 vdcw	
C14	0140-0192	C: fxd, mica, 68 pf ±5%, 300 vdcw	
C15	0140-0193	C: fxd, mica, 82 pf ±5%, 300 vdcw	
C16	0150-0121	C: fxd, cer, 0.1 uf +80% -20%, 50 vdcw	
C17	0140-0192	C: fxd, mica, 68 pf ±5%, 300 vdcw	
CR1 thru CR8	1901-0025	Diode, Si	
CR9	1910-0021	Diode, Ge	
CR10	1901-0040	Diode, Si	
CR11 thru CR13	1910-0021	Diode, Ge	
CR14	1901-0040	Diode, Si	
CR15 thru CR20	1910-0021	Diode, Ge	
DS1 thru DS4	G-84H	Lamp, Ne: matched pair	
DS5		Not assigned	
DS6	1970-0009	Tube, electron	
Q1 thru Q8	1850-0067	Transistor: 2N1495	
R1	0686-4735	R: fxd, comp, 47K ohms ±5%, 1/2 W	
R2	0854-0001	Resistor network	
R3 thru R5		Not assigned	
R6 thru R9	0693-3945	R: fxd, comp, 390K ohms ±5%, 1/4 W	
R10 thru R17	0683-5635	R: fxd, comp, 56K ohms ±5%, 1/4 W	
R18	0758-0043	R: fxd, mfgl, 1800 ohms ±5%, 1/2 W	
R19	0683-1535	R: fxd, comp, 15K ohms ±5%, 1/4 W	
R20	0683-2725	R: fxd, comp, 2700 ohms ±5%, 1/4 W	
R21	0683-1045	R: fxd, comp, 100K ohms ±5%, 1/4 W	
R22	0683-2705	R: fxd, comp, 27 ohms ±5%, 1/4 W	
R23	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R24	0683-5605	R: fxd, comp, 56 ohms ±5%, 1/4 W	
R25	0683-2705	R: fxd, comp, 27 ohms ±5%, 1/4 W	
R26	0758-0043	R: fxd, mfgl, 1800 ohms ±5%, 1/2 W	
R27	0683-1535	R: fxd, comp, 15K ohms ±5%, 1/4 W	
R28	0683-2725	R: fxd, comp, 2700 ohms ±5%, 1/4 W	
R29	0758-0043	R: fxd, mfgl, 1800 ohms ±5%, 1/2 W	
R30	0683-1535	R: fxd, comp, 15K ohms ±5%, 1/4 W	
R31	0683-2725	R: fxd, comp, 2700 ohms ±5%, 1/4 W	
R32	0683-1045	R: fxd, comp, 100K ohms ±5%, 1/4 W	
R33	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	

See introduction to this section

Table IA-2. Decimal Counter Assy (designations prefixed A16) cont'd

Circuit Reference	Stock No.	Description #	Note
R34	0683-2705	R: fxd, comp, 27 ohms ±5%, 1/4 W	
R35	0683-5605	R: fxd, comp, 56 ohms ±5%, 1/4 W	
R36	0758-0043	R: fxd, mfgl, 1800 ohms ±5%, 1/2 W	
R37	0683-1535	R: fxd, comp, 15K ohms ±5%, 1/4 W	
R38	0683-2725	R: fxd, comp, 2700 ohms ±5%, 1/4 W	
R39	0757-0079	R: fxd, mfgl, 2700 ohms ±2%, 1/2 W	
R40	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R41	0683-1825	R: fxd, comp, 1800 ohms ±5%, 1/4 W	
R42	0683-1045	R: fxd, comp, 100K ohms ±5%, 1/4 W	
R43	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R44	0683-2705	R: fxd, comp, 27 ohms ±5%, 1/4 W	
R45	0683-7505	R: fxd, comp, 75 ohms ±5%, 1/4 W	
R46	0683-1025	R: fxd, comp, 1000 ohms ±5%, 1/4 W	
R47	0683-2705	R: fxd, comp, 27 ohms ±5%, 1/4 W	
R48	0757-0079	R: fxd, mfgl, 2700 ohms ±2%, 1/2 W	
R49	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R50	0683-1825	R: fxd, comp, 1800 ohms ±5%, 1/4 W	
R51	0683-5635	R: fxd, comp, 56K ohms ±5%, 1/4 W	
R52	0683-3025	R: fxd, comp, 3000 ohms ±5%, 1/4 W	
R53	0757-0079	R: fxd, mfgl, 2700 ohms ±2%, 1/2 W	
R54	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R55	0683-1825	R: fxd, comp, 1800 ohms ±5%, 1/4 W	
R56	0683-1045	R: fxd, comp, 100K ohms ±5%, 1/4 W	
R57	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R58	0683-7505	R: fxd, comp, 75 ohms ±5%, 1/4 W	
R59	0683-1025	R: fxd, comp, 1000 ohms ±5%, 1/4 W	
R60	0757-0079	R: fxd, mfgl, 2700 ohms ±2%, 1/2 W	
R61	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R62	0683-1825	R: fxd, comp, 1800 ohms ±5%, 1/4 W	
R63	0683-2705	R: fxd, comp, 27 ohms ±5%, 1/4 W	

See introduction to this section



NOTES

1. REFERENCE DESIGNATIONS WITHIN DECADE DIVIDER ASSEMBLY ARE INCOMPLETE TO FORM COMPLETE REFERENCE DESIGNATION, ADD ASSEMBLY DESIGNATION A26A5 PREFIX TO INDICATED DESIGNATION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS RESISTORS 1/4 WATT

RESET WIRING

RESET NUMERAL	RESET PULSE (NEGATIVE) PIN CONNECTIONS			
0	2	5	7	9
1	1	5	7	9
2	2	6	7	9
3	1	6	7	9
4	2	6	7	10
5	1	6	7	10
6	2	5	8	10
7	1	5	8	10
8	2	6	8	10
9	1	6	8	10

REFERENCE DESIGNATIONS

C1	C7
CR2	I1
R1	I2
R1	46

DELETED: A26CR1

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Figure IA-4

Table IA-3. Decade Divider Assy 5232A-65C (designations prefixed A28)

Circuit Reference	℔ Stock No.	Description #	Note
C1, C2	0140-0194	C: fxd, mica, 110 pf ±5%, 300 vdcw	
C3	0140-0204	C: fxd, mica, 47 pf ±5%, 300 vdcw	
C4	0150-0023	C: fxd, cer, 2000 pf ±20%, 1000 vdcw	
C5	0140-0204	C: fxd, mica, 47 pf ±5%, 500 vdcw	
C6	0140-0192	C: fxd, mica, 68 pf ±5%, 300 vdcw	
C7	0140-0193	C: fxd, mica, 82 pf ±5%, 300 vdcw	
C8	0150-0023	C: fxd, cer, 2000 pf ±20%, 1000 vdcw	
C9	0140-0193	C: fxd, mica, 82 pf ±5%, 300 vdcw	
C10	0140-0195	C: fxd, mica, 130 pf ±5%, 300 vdcw	
C11, C12	0140-0194	C: fxd, mica, 110 pf ±5%, 300 vdcw	
C13	0140-0196	C: fxd, mica, 150 pf ±5%, 300 vdcw	
C14	0140-0195	C: fxd, mica, 130 pf ±5%, 300 vdcw	
C15, C16	0140-0194	C: fxd, mica, 110 pf ±5%, 300 vdcw	
C17	0150-0121	C: fxd, cer, 0.1 μf +80% -20%, 50 vdcw	
CR1		Not assigned	
CR2 thru CR11	1910-0016	Diode, Ge: 100 ma @1V, 60 PIV	
Q1 thru Q4	1850-0037	Transistor: 2N274	
Q5 thru Q8	1850-0062	Transistor: Ge	
R1	0683-1025	R: fxd, comp, 1K ohms ±5%, 1/4 W	
R2	0758-0010	R: fxd, metallic oxide, 3.3K ohms ±5%, 1/2 W	
R3	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R4	0683-1825	R: fxd, comp, 1.8K ohms ±5%, 1/4 W	
R5	0683-2235	R: fxd, comp, 22K ohms ±5%, 1/4 W	
R6	0683-1015	R: fxd, comp, 100 ohms ±5%, 1/4 W	
R7	0683-1025	R: fxd, comp, 1K ohms ±5%, 1/4 W	
R8	0683-2235	R: fxd, comp, 22K ohms ±5%, 1/4 W	
R9	0758-0010	R: fxd, metallic oxide, 3.3K ohms ±5%, 1/2 W	
R10	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R11	0683-1825	R: fxd, comp, 1.8K ohms ±5%, 1/4 W	
R12	0758-0010	R: fxd, metallic oxide, 3.3K ohms ±5%, 1/2 W	
R13	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R14	0683-1825	R: fxd, comp, 1.8K ohms ±5%, 1/4 W	
R15	0683-2235	R: fxd, comp, 22K ohms ±5%, 1/4 W	
R16	0683-1015	R: fxd, comp, 100 ohms ±5%, 1/4 W	
R17	0683-1025	R: fxd, comp, 1K ohms ±5%, 1/4 W	
R18	0683-2235	R: fxd, comp, 22K ohms ±5%, 1/4 W	
R19	0758-0010	R: fxd, metallic oxide, 3.3K ohms ±5%, 1/2 W	
R20	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R21	0683-1825	R: fxd, comp, 1.8K ohms ±5%, 1/4 W	
R22	0758-0010	R: fxd, metallic oxide, 3.3K ohms ±5%, 1/2 W	
R23	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R24	0683-1825	R: fxd, comp, 1.8K ohms ±5%, 1/4 W	
R25	0683-2235	R: fxd, comp, 22K ohms ±5%, 1/4 W	
R26	0683-1015	R: fxd, comp, 100 ohms ±5%, 1/4 W	
R27	0683-1025	R: fxd, comp, 1K ohms ±5%, 1/4 W	
R28	0683-2235	R: fxd, comp, 22K ohms ±5%, 1/4 W	

See introduction to this section

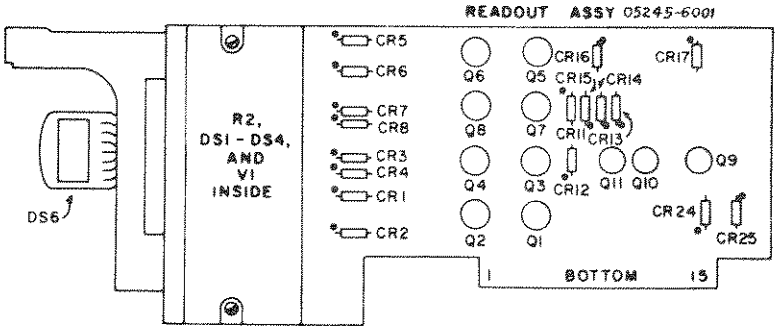
Table 1A-3. Decade Divider Assy 5232A-65C (designations prefixed A28) Cont'd

Circuit Reference	℗ Stock No.	Description#	Note
R29	0758-0010	R: fxd, metallic oxide, 3.3K ohms ±5%, 1/2 W	
R30	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R31	0683-1825	R: fxd, comp, 1.8K ohms ±5%, 1/4 W	
R32	0683-5635	R: fxd, comp, 56K ohms ±5%, 1/4 W	
R33	0683-3025	R: fxd, comp, 3K ohms ±5%, 1/4 W	
R34	0758-0010	R: fxd, metallic oxide, 3.3K ohms ±5%, 1/2 W	
R35	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R36	0683-1825	R: fxd, comp, 1.8K ohms ±5%, 1/4 W	
R37	0683-2235	R: fxd, comp, 22K ohms ±5%, 1/4 W	
R38	0683-1015	R: fxd, comp, 100 ohms ±5%, 1/4 W	
R39	0683-1025	R: fxd, comp, 1K ohms ±5%, 1/4 W	
R40	0683-2235	R: fxd, comp, 22K ohms ±5%, 1/4 W	
R41	0758-0010	R: fxd, metallic oxide, 3.3K ohms ±5%, 1/2 W	
R42	0683-1835	R: fxd, comp, 18K ohms ±5%, 1/4 W	
R43	0683-1825	R: fxd, comp, 1.8K ohms ±5%, 1/4 W	
R44	0758-0014	R: fxd, mfgl, 180 ohms ±5%, 1/2 W	

See introduction to this section

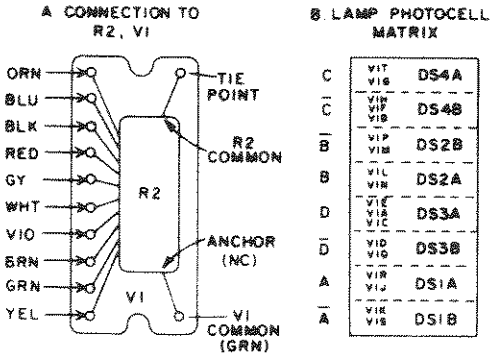
APPENDIX II - OPTION 02

The 5245L - Option 02 instruments use decimal counters with a 1248 four-line code, Schematics for the three types used in the Model 5245L are shown in Figures IIA-1, IIA-2, and IIA-3. Parts lists for the three types are given in Tables IIA-1, IIA-2, and IIA-3.



COMPONENT LOCATION

PHYSICAL LAYOUT



REFERENCE DESIGNATIONS

C1
CR1 - 25
DS1 - 6
Q1 - 11
R1 - 77
V1

OMITTED:
CR9, 10
DS5
R3-5, 23, 31, 39, 47, 50

DELETED:
R25, 33, 41, 49, 57-61, 63
CR18-23
C1

DIGIT	OUTPUT CODE 0≈-10V 1≈+20V				4 LINE CODE (0=-, 1=+)				RELEVANT STAGES				
									V1	AMPLIFIER			
	H	G	F	E	D	C	B	A		D	C	B	A
0	0	0	0	0	0	0	0	0	HPS		■	■	■
1	0	0	0	1	0	0	0	1	DMR	■		■	■
2	0	0	1	0	0	0	1	0	FNS		■	■	■
3	0	0	1	1	0	0	1	1	BLR		■	■	■
4	0	1	0	0	0	1	1	0	KQT	■	■		■
5	0	1	0	1	0	1	1	1	JQT	■	■		■
6	0	1	1	0	1	1	0	0	GPS		■	■	■
7	0	1	1	1	1	1	0	1	CMR	■		■	■
8	1	0	0	0	1	1	1	0	ENS	■		■	■
9	1	0	0	1	1	1	1	1	ALR	■		■	■

NOTES

1. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS
   RESISTORS 1/4 WATT

2. REFERENCE DESIGNATIONS IN PARENTHESES INDICATE LIGHT DESTINATION FOR DS1-DS4; LIGHT SOURCE IS NOTED NEAR EACH V1 SECTION.

3. FILLED SQUARE (■) INDICATES CONDUCTING ELEMENT FOR DECIMAL "0" (BCD "0000").

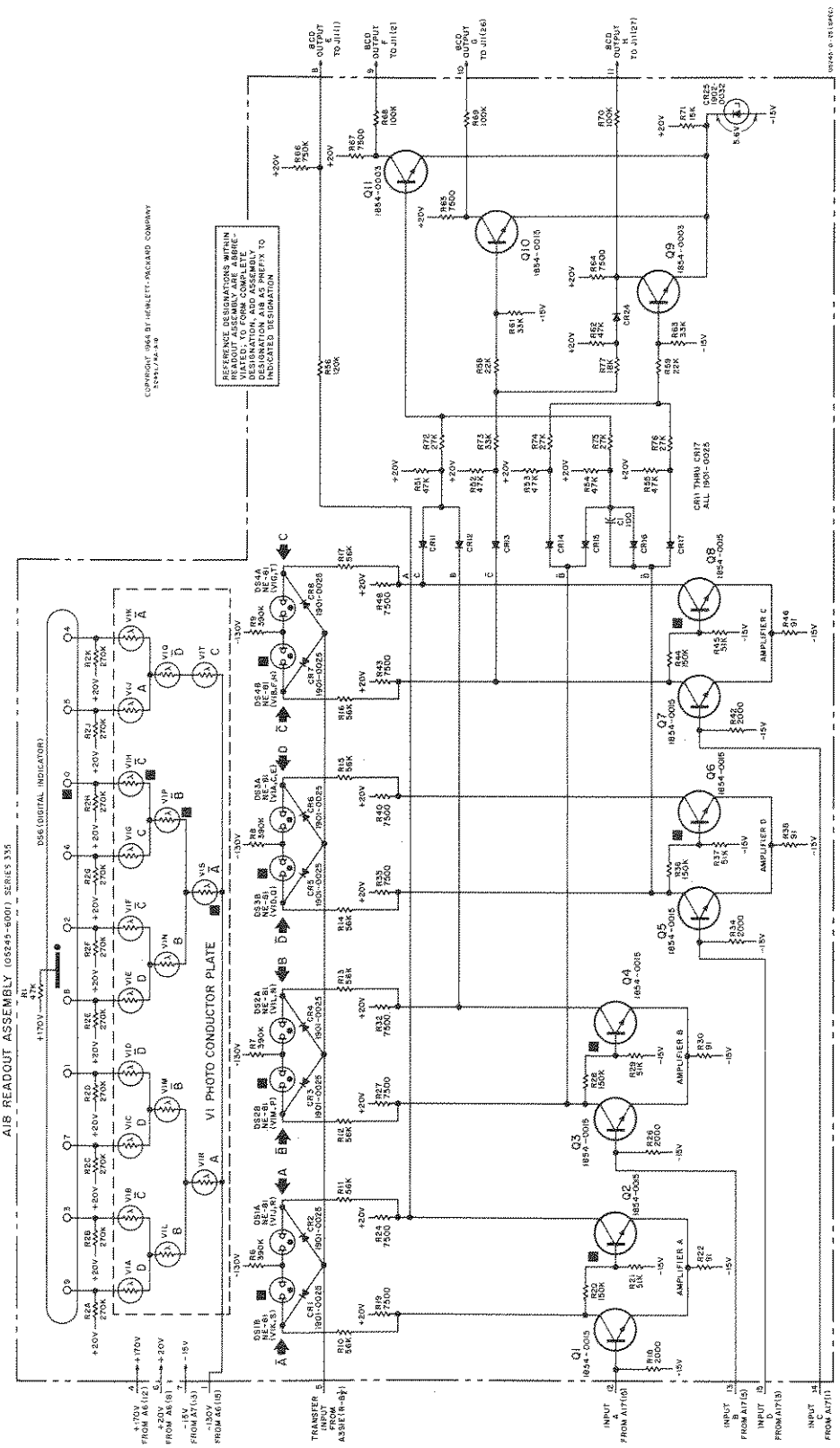

A18 READOUT ASSEMBLY (05245-6001) SERIES 335
DS6 (DIGITAL INDICATOR)
V1 PHOTO CONDUCTOR PLATE
REFERENCE DESIGNATIONS WITHIN READOUT ASSEMBLY ARE ABBREVIATED, TO FORM COMPLETE DESIGNATION ADD ASSEMBLY DESIGNATION A18 AS PREFIX TO INDICATED DESIGNATION
COPYRIGHT 1964 BY HEWLETT-PACKARD COMPANY
BCD OUTPUT
TO J1(11)
TO J1(12)
TO J1(26)
TO J1(27)
Q1 1854-0015
Q2 1854-0015
Q3 1854-0015
Q4 1854-0015
Q5 1854-0015
Q6 1854-0016
Q7 1854-0015
Q8 1854-0015
Q9 1854-0003
Q10 1854-0015
Q11 1854-0003
AMPLIFIER A
AMPLIFIER B
AMPLIFIER C
AMPLIFIER D
CR1 THRU CR17 ALL 1901-0025
+170V FROM A6(12)
+20V FROM A6(8)
-15V FROM A7(3)
-130V FROM A6(15)
TRANSFER (INPUT FROM ASSY(A-19))
INPUT A FROM A17(6)
INPUT B FROM A17(5)
INPUT C FROM A17(3)
INPUT D FROM A17(1)

Figure IIA-1

Table IIA-1 Reference Designation Index

Reference Designation	Stock No.	Description #	Note
	05245-6001	50 MC +1248 READOUT ASSEMBLY	
C1		NOT ASSIGNED	
CR1	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR2	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR3	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR4	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR5	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR6	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR7	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR8	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR9 AND			
CR10		NOT ASSIGNED	
CR11	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR12	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR13	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR14	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR15	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR16	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR17	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR18 THRU			
CR23		NOT ASSIGNED	
CR24	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR25	1902-0032	SEMICON DEVICE:DIODE SILICON JUNCTION	
DS1	2140-0044	LAMP:NEON GLOW MATCHED PAIR(N.R.F.R.)	
DS2	2140-0044	LAMP:NEON GLOW MATCHED PAIR(N.R.F.R.)	
DS3	2140-0044	LAMP:NEON GLOW MATCHED PAIR(N.R.F.R.)	
DS4	2140-0044	LAMP:NEON GLOW MATCHED PAIR(N.R.F.R.)	
DS5		NOT ASSIGNED	
DS6	1970-0009	ELECTRON TUBE INDICATOR 10 DIGIT	
Q1	1854-0015	TRANSISTOR:NPN SILICON BVCBO 50V	
Q2	1854-0015	TRANSISTOR:NPN SILICON BVCBO 50V	
Q3	1854-0015	TRANSISTOR:NPN SILICON BVCBO 50V	
Q4	1854-0015	TRANSISTOR:NPN SILICON BVCBO 50V	
Q5	1854-0015	TRANSISTOR:NPN SILICON BVCBO 50V	
Q6	1854-0015	TRANSISTOR:NPN SILICON BVCBO 50V	
Q7	1854-0015	TRANSISTOR:NPN SILICON BVCBO 50V	
Q8	1854-0015	TRANSISTOR:NPN SILICON BVCBO 50V	
Q9	1854-0003	TRANSISTOR NPN SILICON	
Q10	1854-0015	TRANSISTOR:NPN SILICON BVCBO 50V	
Q11	1854-0003	TRANSISTOR NPN SILICON	
R1	0686-4735	R:FXD COMP 47K OHM 5% 1/2W	
R2	0845-0001	NETWORK:RESISTIVE(10 RESISTORS)N.R.F.R.	
R3 THRU			
R5		NOT ASSIGNED	
R6	0683-3945	R:FXD COMP 390K OHM 5% 1/4W	
R7	0683-3945	R:FXD COMP 390K OHM 5% 1/4W	
R8	0683-3945	R:FXD COMP 390K OHM 5% 1/4W	

See list of abbreviations in introduction to this section

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WOBBER BROS. SAN FRANCISCO SAN JOSE OAKLAND

Table IIA-1 Reference Designation Index (Cont'd)

Reference Designation	Stock No.	Description #	Note
R9	0683-3945	R:FXD COMP 390K OHM 5% 1/4W	
R10	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R11	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R12	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R13	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R14	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R15	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R16	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R17	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R18	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
R19	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
R20	0683-1545	R:FXD COMP 150K OHM 5% 1/4W	
R21	0683-5135	R:FXD COMP 51K OHM 5% 1/4W	
R22	0683-9105	R:FXD COMP 91 OHM 5% 1/4W	
R23		NOT ASSIGNED	
R24	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
R25		NOT ASSIGNED	
R26	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
R27	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
R28	0683-1545	R:FXD COMP 150K OHM 5% 1/4W	
R29	0683-5135	R:FXD COMP 51K OHM 5% 1/4W	
R30	0683-9105	R:FXD COMP 91 OHM 5% 1/4W	
R31		NOT ASSIGNED	
R32	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
R33		NOT ASSIGNED	
R34	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
R35	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
R36	0683-1545	R:FXD COMP 150K OHM 5% 1/4W	
R37	0683-5135	R:FXD COMP 51K OHM 5% 1/4W	
R38	0683-9105	R:FXD COMP 91 OHM 5% 1/4W	
R39		NOT ASSIGNED	
R40	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
R41		NOT ASSIGNED	
R42	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
R43	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
R44	0683-1545	R:FXD COMP 150K OHM 5% 1/4W	
R45	0683-5135	R:FXD COMP 51K OHM 5% 1/4W	
R46	0683-9105	R:FXD COMP 91 OHM 5% 1/4W	
R47		NOT ASSIGNED	
R48	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
R49 THRU			
R50		NOT ASSIGNED	
R51	0683-4735	R:FXD COMP 47K OHM 5% 1/4W	
R52	0683-4735	R:FXD COMP 47K OHM 5% 1/4W	
R53	0683-4735	R:FXD COMP 47K OHM 5% 1/4W	
R54	0683-4735	R:FXD COMP 47K OHM 5% 1/4W	
R55	0683-4735	R:FXD COMP 47K OHM 5% 1/4W	
R56	0683-1245	R:FXD COMP 120K OHM 5% 1/4W	
R57 THRU			
R61		NOT ASSIGNED	
R62	0683-4735	R:FXD COMP 47K OHM 5% 1/4W	

See list of abbreviations in introduction to this section

Table IIA-1 Reference Designation Index (Cont'd)

Reference Designation	℗ Stock No.	Description #	Note
R63	0683-4735	R:FXD COMP 47K OHM 5% 1/4W	
R64	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
R65	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
R66	0683-7545	R:FXD COMP 750K OHM 5% 1/4W	
R67	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
R68	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
R69	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
R70	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
R71	0683-1535	R:FXD COMP 15K OHM 5% 1/4W	
R72	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
R73	0683-3335	R:FXD COMP 33K OHM 5% 1/4W	
R74	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
R75	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
R76	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
R77	0683-1835	R:FXD COMP 18K OHM 5% 1/4W	
V1	1990-0018	PHOTOCONDUCTOR MULTIPLE 4-10 LINE CONVERS. NOT RECOMMENDED FOR FIELD REPLACEMENT	

See list of abbreviations in introduction to this section

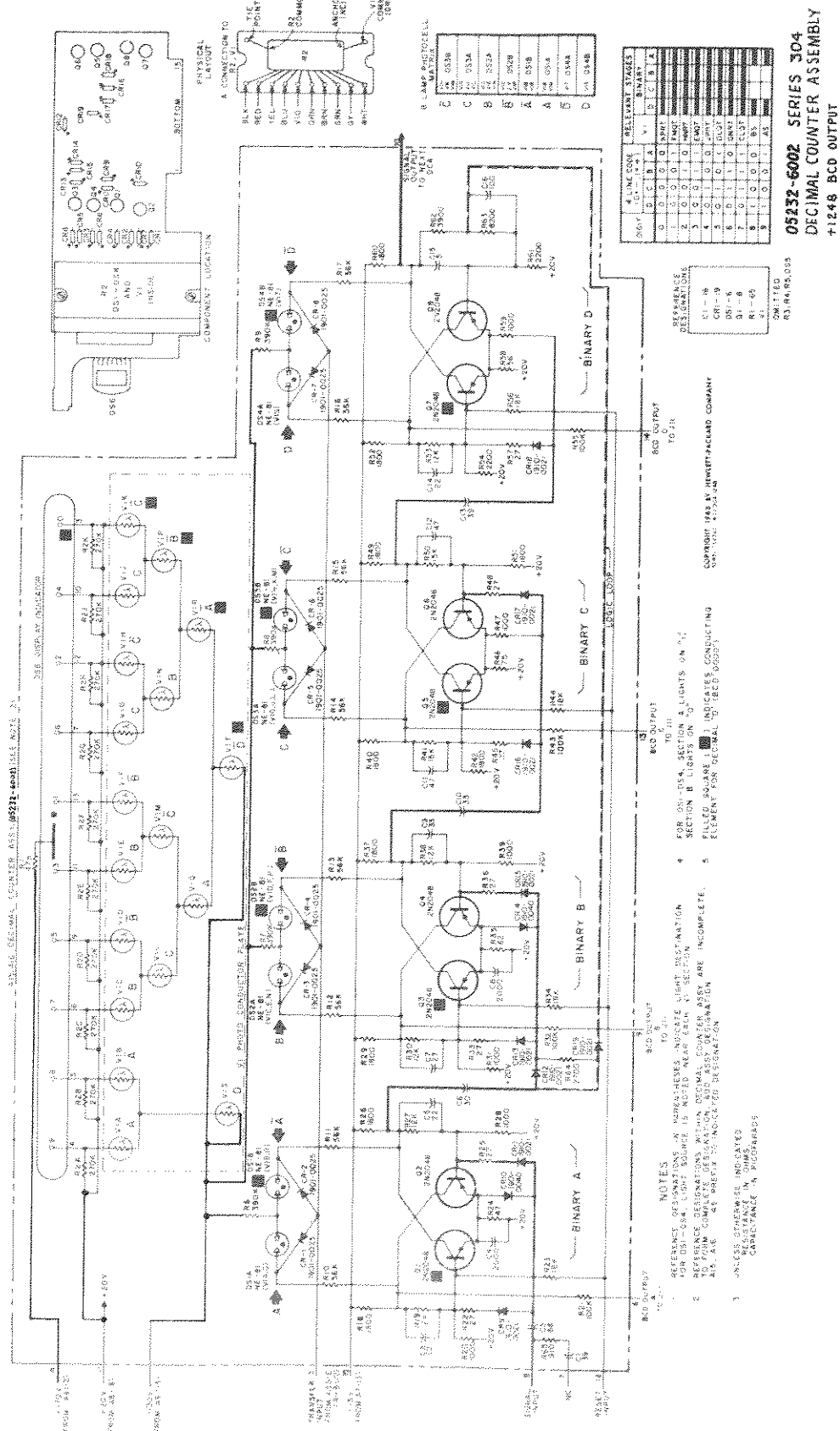

05232-6002 SERIES 304
DECIMAL COUNTER ASSEMBLY
+1248 BCD OUTPUT
BINARY A
BINARY B
BINARY C
BINARY D
NOTES

Figure IIA-2

Table IIA-2 Reference Designation Index (Cont'd)

Reference Designation	℗ Stock No.	Description #	Note
	05232-6002	DECIMAL COUNTER ASSBLY	
C1	0140-0190	C:FXD MICA 39 PF 5% 300 VDCW	
C2	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
C3	0140-0192	C:FXD MICA 68PF 5% 300VDCW	
C4	0150-0122	C:FXD CER 2000PF 20% 500VDCW	
C5	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
C6	0160-0181	C:FXD MICA 30PF 5% 300VDCW	
C7	0160-0178	C:FXD MICA 27PF 5% 300VDCW	
C8	0150-0122	C:FXD CER 2000PF 20% 500VDCW	
C9	0160-0179	C:FXD MICA 33PF 5% 300VDCW	
C10	0160-0179	C:FXD MICA 33PF 5% 300VDCW	
C11	0140-0204	C:FXD MICA 47PF 5% NPO 500VDCW	
C12	0140-0204	C:FXD MICA 47PF 5% NPO 500VDCW	
C13	0140-0190	C:FXD MICA 39 PF 5% 300 VDCW	
C14	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
C15	0140-0209	C:FXD MICA 5PF 10% 500VDCW	
C16	0140-0176	C:FXD MICA 100 PF 2% 300 VDCW	
CR1	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR2	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR3	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR4	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR5	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR6	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR7	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR8	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR9	1910-0021	SEMICON DEVICE:DIODE	
CR10	1901-0040	SEMICON DEVICE:DIODE SILICON	
CR11	1910-0021	SEMICON DEVICE:DIODE	
CR12	1910-0021	SEMICON DEVICE:DIODE	
CR13	1910-0021	SEMICON DEVICE:DIODE	
CR14	1901-0040	SEMICON DEVICE:DIODE SILICON	
CR15	1910-0021	SEMICON DEVICE:DIODE	
CR16	1910-0021	SEMICON DEVICE:DIODE	
CR17	1910-0021	SEMICON DEVICE:DIODE	
CR18	1910-0021	SEMICON DEVICE:DIODE	
CR19	1910-0021	SEMICON DEVICE:DIODE	
DS1	2140-0044	LAMP:NEON SELECTED MATCHED PAIR(N.R.F.R.)	
DS2	2140-0044	LAMP:NEON SELECTED MATCHED PAIR(N.R.F.R.)	
DS3	2140-0044	LAMP:NEON SELECTED MATCHED PAIR(N.R.F.R.)	
DS4	2140-0044	LAMP:NEON SELECTED MATCHED PAIR(N.R.F.R.)	
DS5		NOT ASSIGNED	
DS6	1970-0009	ELECTRON TUBE INDICATOR 10 DIGIT	
Q1	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
Q2	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
Q3	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
Q4	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
Q5	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	

See list of abbreviations in introduction to this section

Table IIA-2 Reference Designation Index (cont'd)

Reference Designation	℗ Stock No.	Description #	Note
Q6	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
Q7	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
Q8	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
R1	0686-4735	R:FXD COMP 47K OHM 5% 1/2W	
R2	0845-0001	NETWORK:RESISTIVE(10 RESISTORS)N.R.F.R.	
R3 THRU			
R5		NOT ASSIGNED	
R6	0683-3945	R:FXD COMP 390K OHM 5% 1/4W	
R7	0683-3945	R:FXD COMP 390K OHM 5% 1/4W	
R8	0683-3945	R:FXD COMP 390K OHM 5% 1/4W	
R9	0683-3945	R:FXD COMP 390K OHM 5% 1/4W	
R10	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R11	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R12	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R13	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R14	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R15	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R16	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R17	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R18	0758-0043	R:FXD MET FLM 1800 OHM 5% 1/2W	
R19	0683-1235	R:FXD COMP 12K OHM 5% 1/4W	
R20	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
R21	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
R22	0683-2705	R:FXD COMP 27 OHM 5% 1/4W	
R23	0683-1835	R:FXD COMP 18K OHM 5% 1/4W	
R24	0683-4705	R:FXD COMP 47 OHM 5% 1/4W	
R25	0683-2705	R:FXD COMP 27 OHM 5% 1/4W	
R26	0758-0043	R:FXD MET FLM 1800 OHM 5% 1/2W	
R27	0683-1235	R:FXD COMP 12K OHM 5% 1/4W	
R28	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
R29	0758-0043	R:FXD MET FLM 1800 OHM 5% 1/2W	
R30	0683-1235	R:FXD COMP 12K OHM 5% 1/4W	
R31	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
R32	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
R33	0683-2705	R:FXD COMP 27 OHM 5% 1/4W	
R34	0683-1835	R:FXD COMP 18K OHM 5% 1/4W	
R35	0683-6205	R:FXD COMP 62 OHM 5% 1/4W	
R36	0683-2705	R:FXD COMP 27 OHM 5% 1/4W	
R37	0758-0043	R:FXD MET FLM 1800 OHM 5% 1/2W	
R38	0683-1235	R:FXD COMP 12K OHM 5% 1/4W	
R39	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
R40	0758-0043	R:FXD MET FLM 1800 OHM 5% 1/2W	
R41	0683-1535	R:FXD COMP 15K OHM 5% 1/4W	
R42	0683-1825	R:FXD COMP 1800 OHM 5% 1/4W	
R43	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
R44	0683-1835	R:FXD COMP 18K OHM 5% 1/4W	
R45	0683-2705	R:FXD COMP 27 OHM 5% 1/4W	
R46	0683-7505	R:FXD COMP 75 OHM 5% 1/4W	
R47	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
R48	0683-2705	R:FXD COMP 27 OHM 5% 1/4W	

See list of abbreviations in introduction to this section

Table IIA-2 Reference Designation Index (cont'd)

Reference Designation	℗ Stock No.	Description #	Note
R49	0758-0043	R:FXD MET FLM 1800 OHM 5% 1/2W	
R50	0683-1535	R:FXD COMP 15K OHM 5% 1/4W	
R51	0683-1825	R:FXD COMP 1800 OHM 5% 1/4W	
R52	0758-0043	R:FXD MET FLM 1800 OHM 5% 1/2W	
R53	0683-1235	R:FXD COMP 12K OHM 5% 1/4W	
R54	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
R55	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
R56	0683-1835	R:FXD COMP 18K OHM 5% 1/4W	
R57	0683-2705	R:FXD COMP 27 OHM 5% 1/4W	
R58	0683-5605	R:FXD COMP 56 OHM 5% 1/4W	
R59	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
R60	0758-0043	R:FXD MET FLM 1800 OHM 5% 1/2W	
R61	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
R62	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
R63	0683-8225	R:FXD COMP 8200 OHM 5% 1/4W	
R64	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
R65	0683-9115	R:FXD COMP 910 OHM 5% 1/4W	
V1	1990-0018	PLATE:PHOTOCONDUCTOR (N.R.F.R.)	

See list of abbreviations in introduction to this section

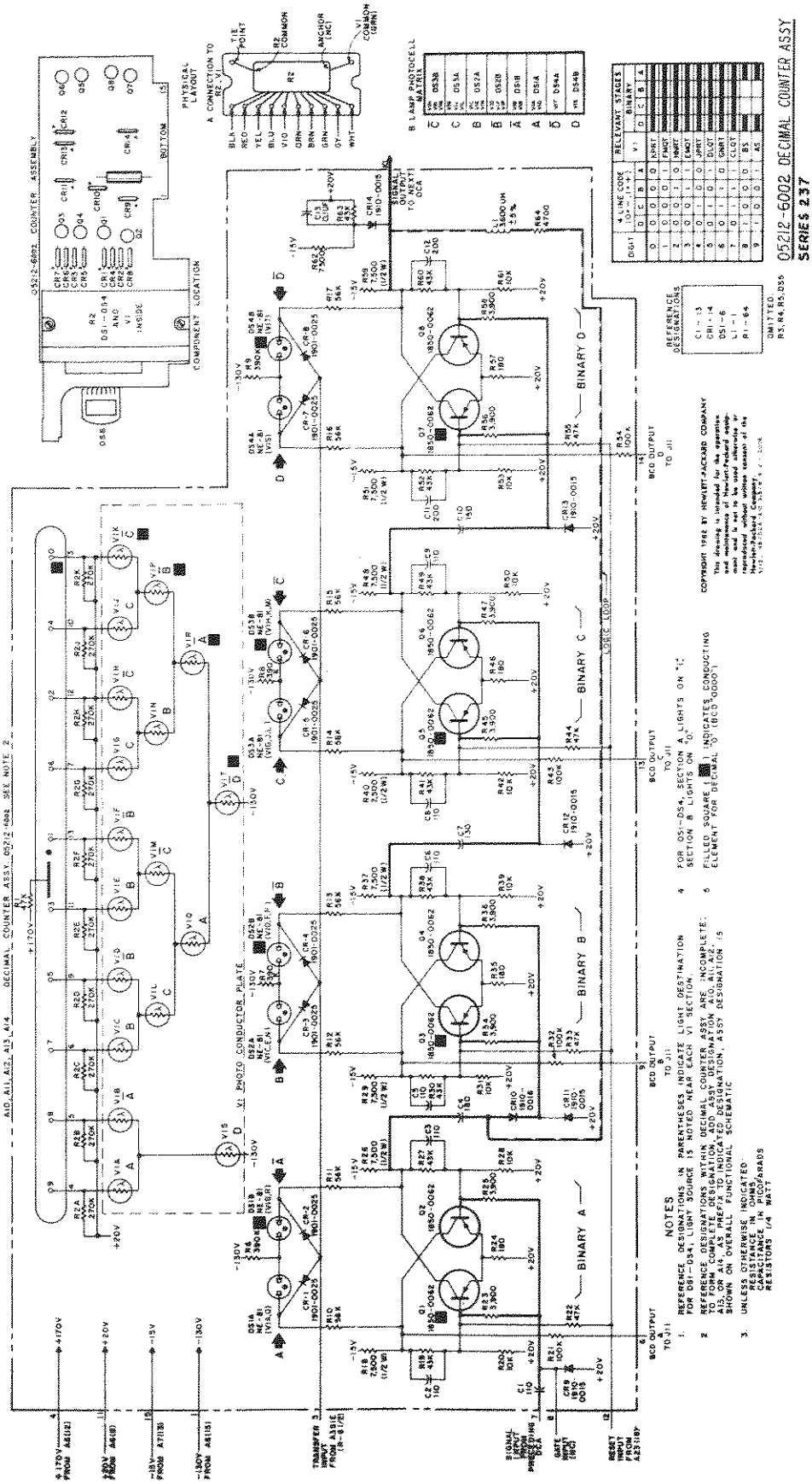

05212-6002 DECIMAL COUNTER ASSY
SERIES 237
+1248 BCD OUTPUT
NOTES
REFERENCE DESIGNATIONS IN PARENTHESES INDICATE LIGHT DESTINATION FOR DS1-DS4, LIGHT SOURCE IS NOTED NEAR EACH V1 SECTION.
REFERENCE DESIGNATIONS WITHIN DECIMAL COUNTER ASSY ARE INCOMPLETE: TO FORM COMPLETE DESIGNATION, ADD ASSY DESIGNATION A10, A11, A12, A13, OR A14. X'S PREFIX TO INDICATED DESIGNATION, ASSY DESIGNATION IS SHOWN ON OVERALL FUNCTIONAL SCHEMATIC
UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS RESISTORS 1/4 WATT
FOR DS1-DS4, SECTION A LIGHTS ON "0", SECTION B LIGHTS ON "1".
FILLED SQUARE (■) INDICATES CONDUCTING ELEMENT FOR DECIMAL "0" (BCD 0000).
BINARY A
BINARY B
BINARY C
BINARY D
BCD OUTPUT
4 LINE CODE
RELEVANT STAGES
REFERENCE DESIGNATIONS
OMITTED: R5, R4, R5, R55
COPYRIGHT 1962 BY HEWLETT-PACKARD COMPANY

Figure IIA-3

Table IIA-3 Reference Designation Index (Cont'd)

Reference Designation	℗ Stock No.	Description #	Note
	05212-6002	DECIMAL COUNTER ASSEMBLY	
C1	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
C2	0140-0217	C:FXD MICA 140PF 2% 300VDCW	
C3	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
C4	0140-0197	C:FXD MICA 180 PF 5% 300 VDCW	
C5	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
C6	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
C7	0140-0195	C:FXD MICA 130 PF 5% 300 VDCW	
C8	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
C9	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
C10	0140-0196	C:FXD MICA 150 PF 5% 300 VDCW	
C11	0140-0198	C:FXD MICA 200PF 5% 300VDCW	
C12	0140-0198	C:FXD MICA 200PF 5% 300VDCW	
C13	0150-0121	C:FXD:CER:0.1UF 50 VDCW	
CR1	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR2	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR3	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR4	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR5	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR6	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR7	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR8	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
CR9	1910-0015	SEMICON DEVICE:DIODE GERMANIUM	
CR10	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
CR11	1910-0015	SEMICON DEVICE:DIODE GERMANIUM	
CR12	1910-0015	SEMICON DEVICE:DIODE GERMANIUM	
CR13	1910-0015	SEMICON DEVICE:DIODE GERMANIUM	
CR14	1910-0015	SEMICON DEVICE:DIODE GERMANIUM	
DS1	2140-0044	LAMP:NEON SELECTED MATCHED PAIR(N.R.F.R.)	
DS2	2140-0044	LAMP:NEON SELECTED MATCHED PAIR(N.R.F.R.)	
DS3	2140-0044	LAMP:NEON SELECTED MATCHED PAIR(N.R.F.R.)	
DS4	2140-0044	LAMP:NEON SELECTED MATCHED PAIR(N.R.F.R.)	
DS5		NOT ASSIGNED	
DS6	1970-0009	ELECTRON TUBE INDICATOR 10 DIGIT	
DS7		NOT ASSIGNED	
L1	9140-0161	COIL:FXD 360UH 5%	
Q1	1850-0062	TRANSISTOR GERMANIUM PNP SELECTED	
Q2	1850-0062	TRANSISTOR GERMANIUM PNP SELECTED	
Q3	1850-0062	TRANSISTOR GERMANIUM PNP SELECTED	
Q4	1850-0062	TRANSISTOR GERMANIUM PNP SELECTED	
Q5	1850-0062	TRANSISTOR GERMANIUM PNP SELECTED	
Q6	1850-0062	TRANSISTOR GERMANIUM PNP SELECTED	
Q7	1850-0062	TRANSISTOR GERMANIUM PNP SELECTED	
Q8	1850-0062	TRANSISTOR GERMANIUM PNP SELECTED	
R1	0686-4735	R:FXD COMP 47K OHM 5% 1/2W	
R2	0845-0001	NETWORK:RESISTIVE(10 RESISTORS)N.R.F.R.	

See list of abbreviations in introduction to this section

Table IIA-3 Reference Designation Index (Cont'd)

Reference Designation	℗ Stock No.	Description #	Note
R3 THRU R5		NOT ASSIGNED	
R6	0683-3945	R:FXD COMP 390K OHM 5% 1/4W	
R7	0683-3945	R:FXD COMP 390K OHM 5% 1/4W	
R8	0683-3945	R:FXD COMP 390K OHM 5% 1/4W	
R9	0683-3945	R:FXD COMP 390K OHM 5% 1/4W	
R10	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R11	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R12	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R13	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R14	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R15	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R16	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R17	0683-5635	R:FXD COMP 56K OHM 5% 1/4W	
R18	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
R19	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
R20	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
R21	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
R22	0683-4735	R:FXD COMP 47K OHM 5% 1/4W	
R23	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
R24	0683-1815	R:FXD COMP 180 OHM 5% 1/4W	
R25	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
R26	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
R27	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
R28	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
R29	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
R30	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
R31	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
R32	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
R33	0683-4735	R:FXD COMP 47K OHM 5% 1/4W	
R34	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
R35	0683-1815	R:FXD COMP 180 OHM 5% 1/4W	
R36	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
R37	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
R38	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
R39	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
R40	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
R41	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
R42	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
R43	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
R44	0683-4735	R:FXD COMP 47K OHM 5% 1/4W	
R45	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
R46	0683-1815	R:FXD COMP 180 OHM 5% 1/4W	
R47	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
R48	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
R49	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
R50	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
R51	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
R52	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
R53	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
R54	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	

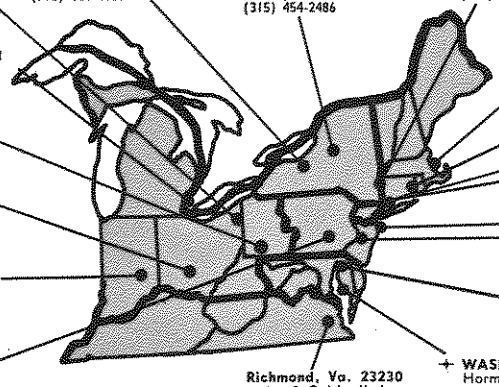
See list of abbreviations in introduction to this section

Table IIA-3 Reference Designation Index (Cont'd)

Reference Designation	Stock No.	Description #	Note
R55	0683-4735	R:FXD COMP 47K OHM 5% 1/4W	
R56	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
R57	0683-1815	R:FXD COMP 180 OHM 5% 1/4W	
R58	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
R59	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
R60	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
R61	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
R62	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
R63	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
R64	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
V1	1990-0018	PHOTOCONDUCTOR PLATE	
		GASKET:PHOTOCONDUCTOR	
		GASKET:FELT	
		BOARD:DECIMAL COUNTER	
		COVER:COLUMN	
		BLOCK:PHOTOCONDUCTOR	
		READOUT:INLINE	

See list of abbreviations in introduction to this section

HEWLETT-PACKARD SALES AND SERVICE OFFICES IN NORTH AMERICA



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Crossley Associates, Inc.
5579 Pearl Road
(216) 884-9209

+ **Rochester, N. Y. 14625**
Syracuse Sales Division
Hewlett-Packard Company
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(716) 381-4120

+ **Syracuse, N. Y. 13211**
Syracuse Sales Division
Hewlett-Packard Company
Pickard Bldg.
Molloy Rd. and Pickard Dr.
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+ **Poughkeepsie, N. Y. 12601**
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(301) 664-4400

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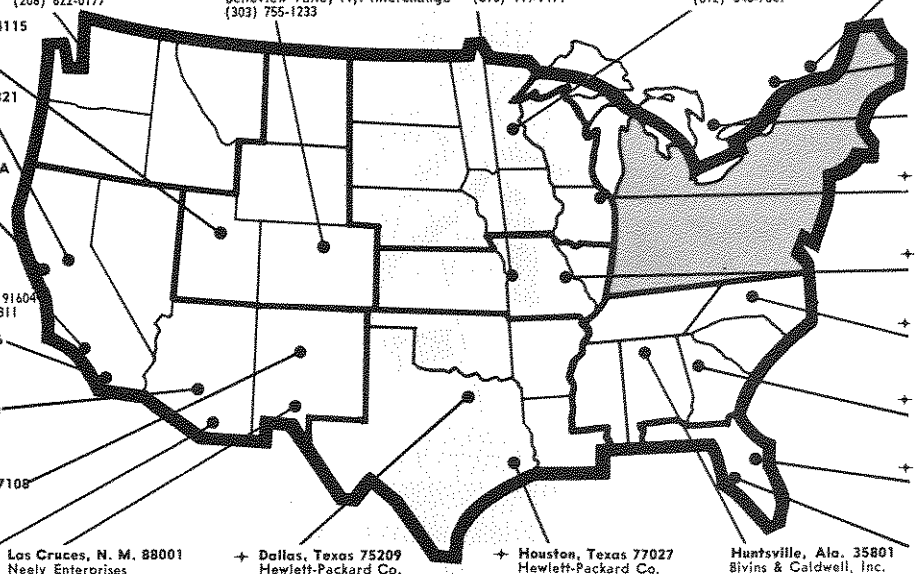
Rockville, Md. 20852
(301) 427-7560



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1320 Prospect Street
(206) 622-0177

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+ Indicates Instrument Repair Stations

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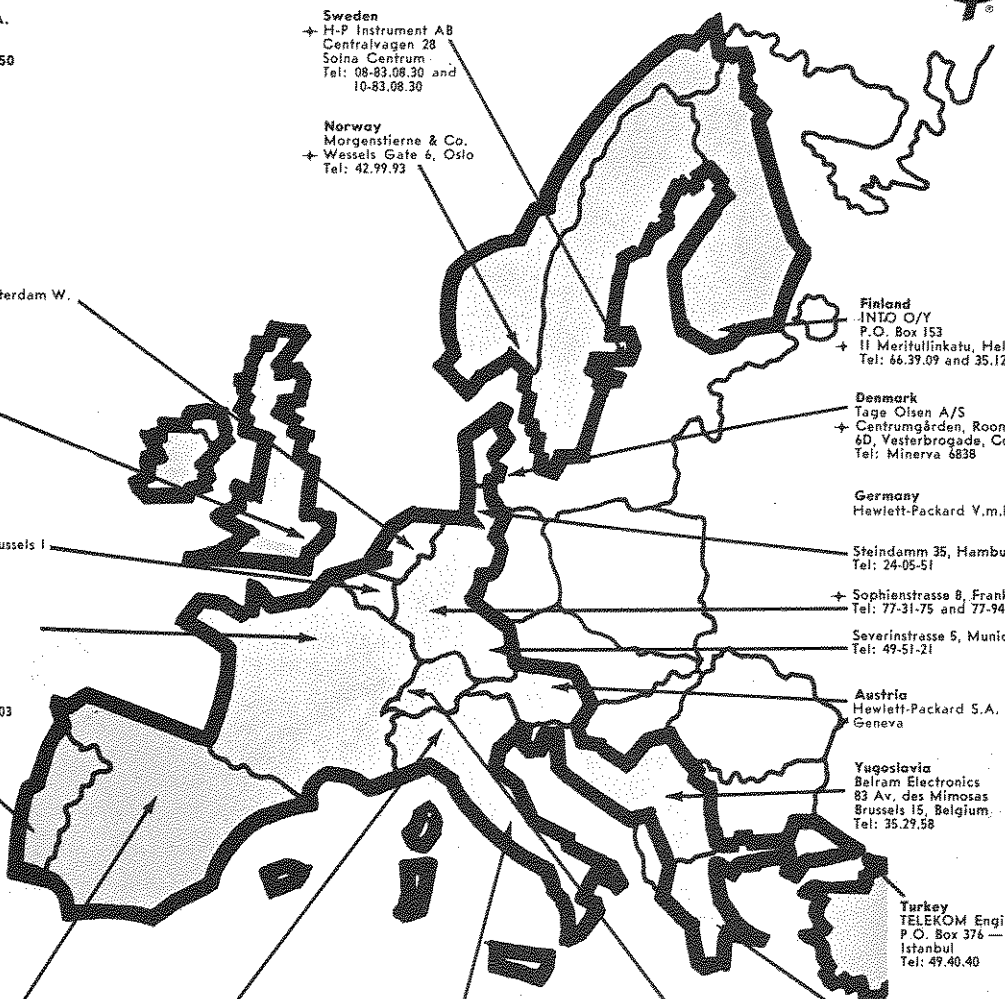

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+ H-P Instrument AB
Centralvagen 28
Solna Centrum
Tel: 08-83.08.30 and
10-83.08.30

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Morgenstierne & Co.
+ Wessels Gate 6, Oslo
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Paris 13e

Portugal
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Lisbon I
Tel: 68 60 72
68 60 73
68 60 74

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Bombay 1
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Sumi Bldg., 106 Umegae-cho
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Seóul
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21 Nanking West Road, Taipei
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Hewlett-Packard Company
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Palo Alto, California 94304 U.S.A.
Telephone: (415) 326-7000
TWX: 415-492-9200
Telex: 033811
Cable: HEWPACK

+ Indicates Instrument Repair Stations

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All our products are warranted against defects in materials and workmanship for one year from the date of shipment. Our obligation is limited to repairing or replacing products (except tubes) which prove to be defective during the warranty period. We are not liable for consequential damages.

For assistance of any kind, including help with instruments under warranty, contact your nearest Hewlett-Packard field office for instructions. Give full details of the difficulty and include the instrument model and serial numbers. Service data or shipping instructions will be promptly sent to you. There will be no charge for repair of instruments under warranty, *except transportation charges*. Estimates of charges for non-warranty or other service work will always be supplied, if requested, before work begins.

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Palo Alto, California, 94306
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TWX No. (415) 492-9363
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